US010998666B2

(12) **United States Patent**
Shioda et al.

(10) **Patent No.: US 10,998,666 B2**
(45) **Date of Patent: *May 4, 2021**

(54) **MOVABLE CONNECTOR**

(71) Applicant: **IRISO ELECTRONICS CO., LTD.**, Kanagawa (JP)

(72) Inventors: **Hideki Shioda**, Kanagawa (JP); **Yoshihito Ohkuma**, Kanagawa (JP)

(73) Assignee: **IRISO ELECTRONICS CO., LTD.**, Kanagawa (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **16/658,661**

(22) Filed: **Oct. 21, 2019**

(65) **Prior Publication Data**

US 2020/0127410 A1 Apr. 23, 2020

(30) **Foreign Application Priority Data**

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Oct. 23, 2018 (JP) JP2018-199155

(51) **Int. Cl.**
H01R 13/506 (2006.01)
H01R 13/11 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***H01R 13/506*** (2013.01); ***H01R 12/91*** (2013.01); ***H01R 13/11*** (2013.01); ***H01R 13/20*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC .. H01R 12/716; H01R 12/91; H01R 13/6315; H01R 12/707; H01R 12/73;
(Continued)

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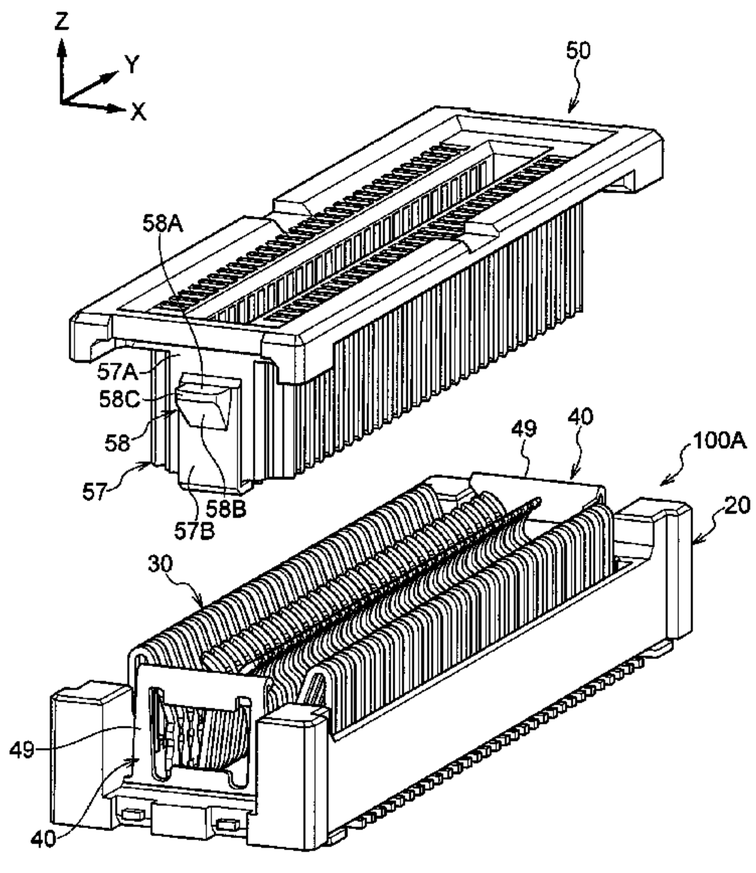
Primary Examiner — Edwin A. Leon
Assistant Examiner — Matthew T Dzierzynski
(74) *Attorney, Agent, or Firm* — Westman, Champlin & Koehler, P.A.

(57) **ABSTRACT**

A movable connector including a stationary housing to be fixed to a substrate, a movable housing configured capable of moving relative to the stationary housing, and a terminal including a stationary-side retained portion retained at the stationary housing, a movable-side retained portion retained at the movable housing, and an elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion. Retention of the stationary-side retained portion with respect to the stationary housing is achieved by performing insert molding. Retention of the movable-side retained portion with respect to the movable housing is achieved by performing press-fitting.

6 Claims, 34 Drawing Sheets



(51) **Int. Cl.**

H01R 13/41	(2006.01)
H01R 43/24	(2006.01)
H01R 12/91	(2011.01)
H01R 13/20	(2006.01)
H01R 13/631	(2006.01)
H01R 12/71	(2011.01)
H01R 24/60	(2011.01)
H01R 107/00	(2006.01)

(52) **U.S. Cl.**
CPC ***H01R 13/41*** (2013.01); ***H01R 13/6315*** (2013.01); ***H01R 43/24*** (2013.01); *H01R 12/716* (2013.01); *H01R 24/60* (2013.01); *H01R 2107/00* (2013.01)

(58) **Field of Classification Search**
CPC .. H01R 13/405; H01R 2107/00; H01R 13/41; H01R 12/57; H01R 13/20; H01R 24/60; H01R 12/7005; H01R 12/712; H01R 13/502; H01R 12/52; H01R 12/737; H01R 13/506; H01R 43/24
USPC 439/74, 660, 247, 248, 188, 578, 626, 83
See application file for complete search history.

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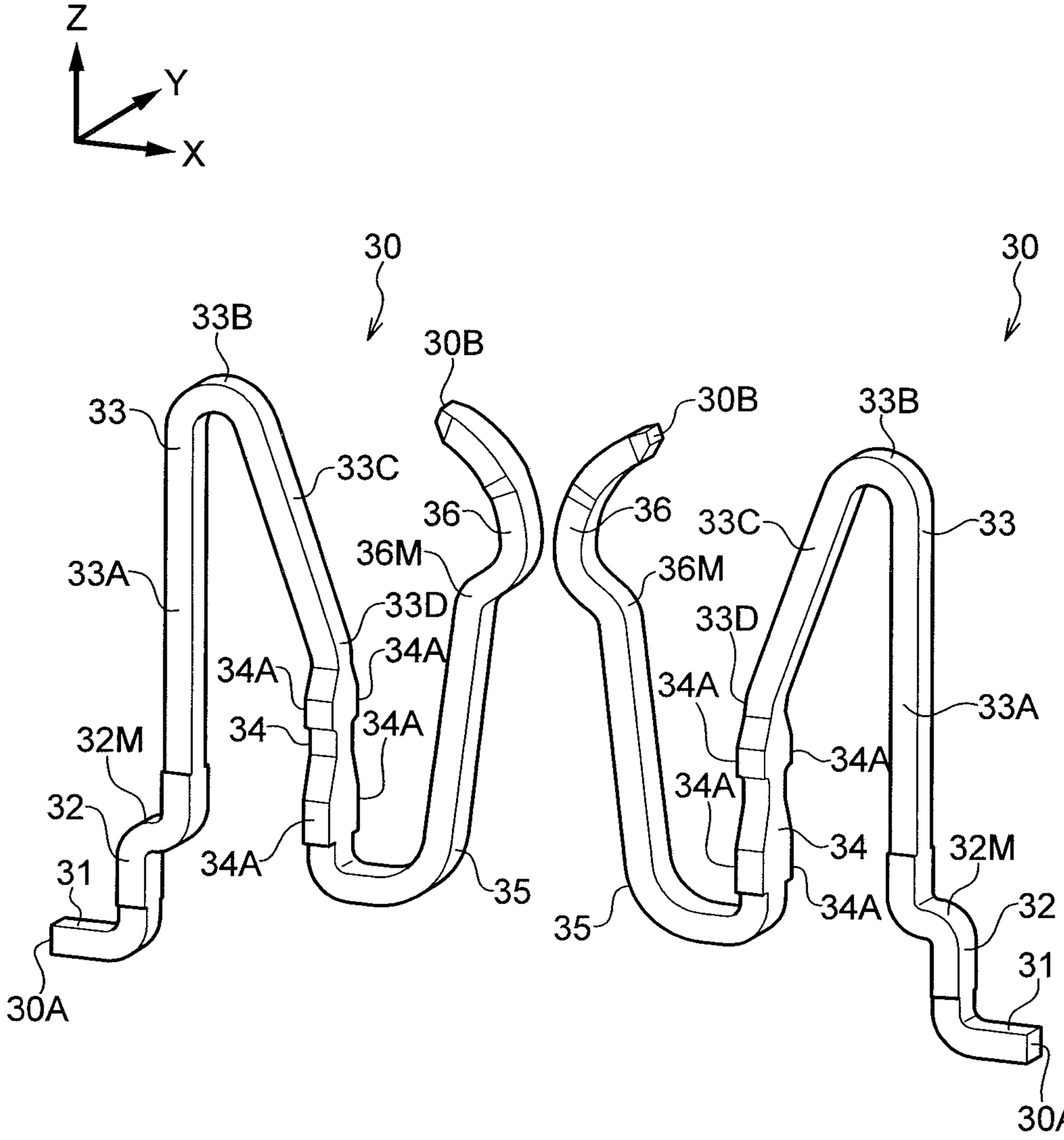
FIG.1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30A
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30B
33B
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35
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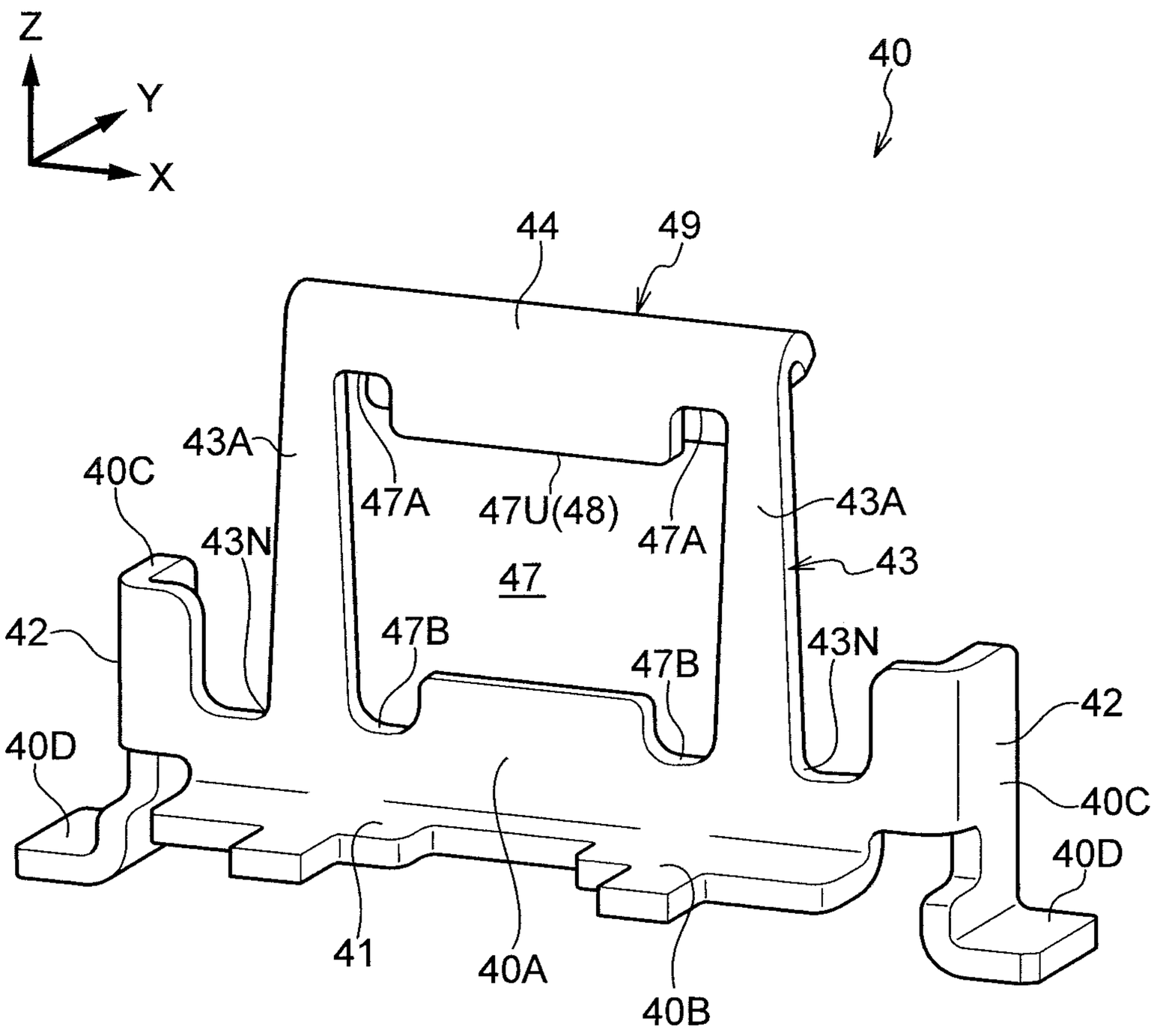
30A

FIG.2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47B
47B
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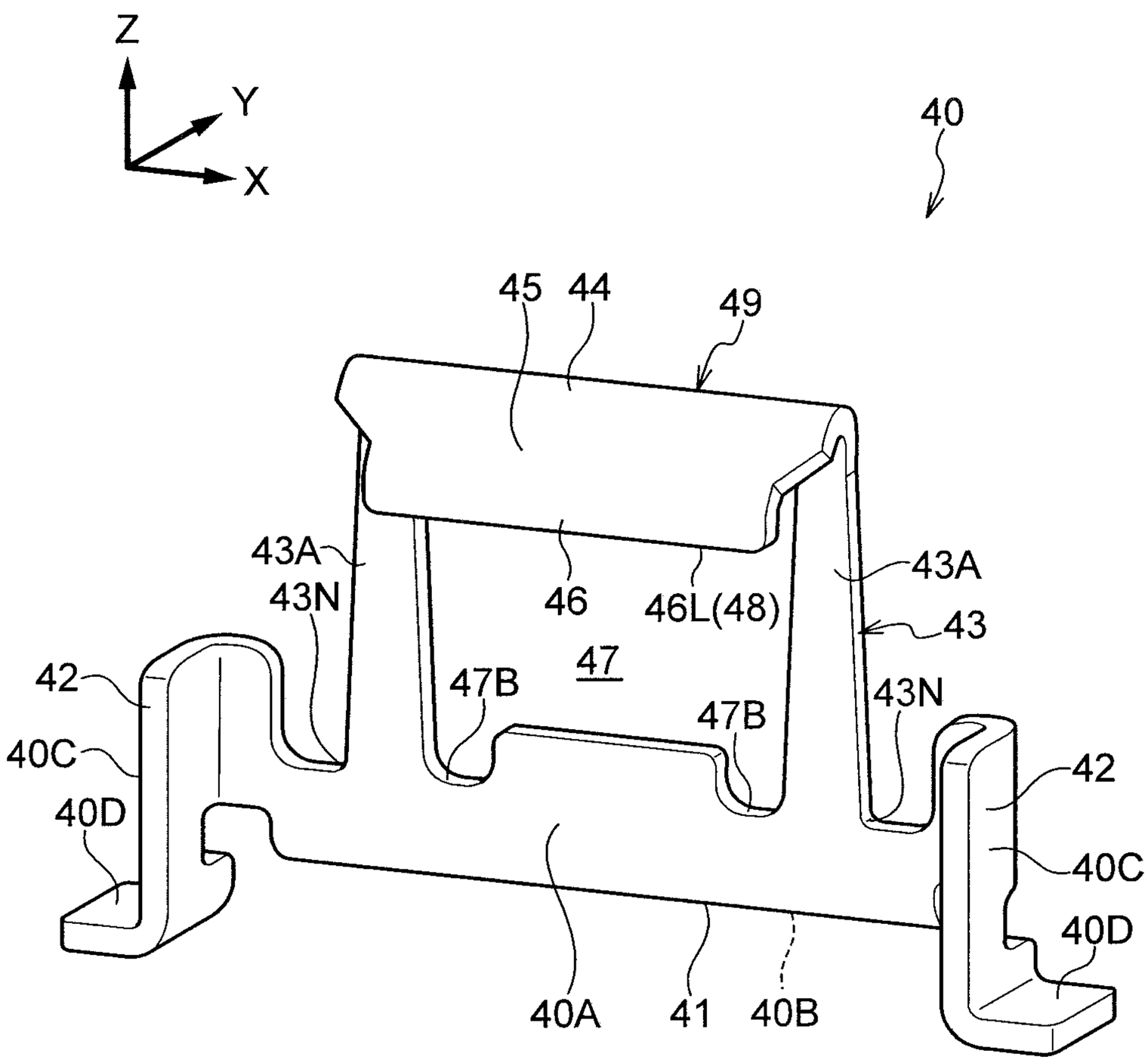
40D
40C
40D
41
40A
40B

FIG.3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Y
X
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45
44
49
43A
43N
46
46L(48)
43A
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47B
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43N
40C
42
40D
40C
40D
40A
41
40B

FIG.4

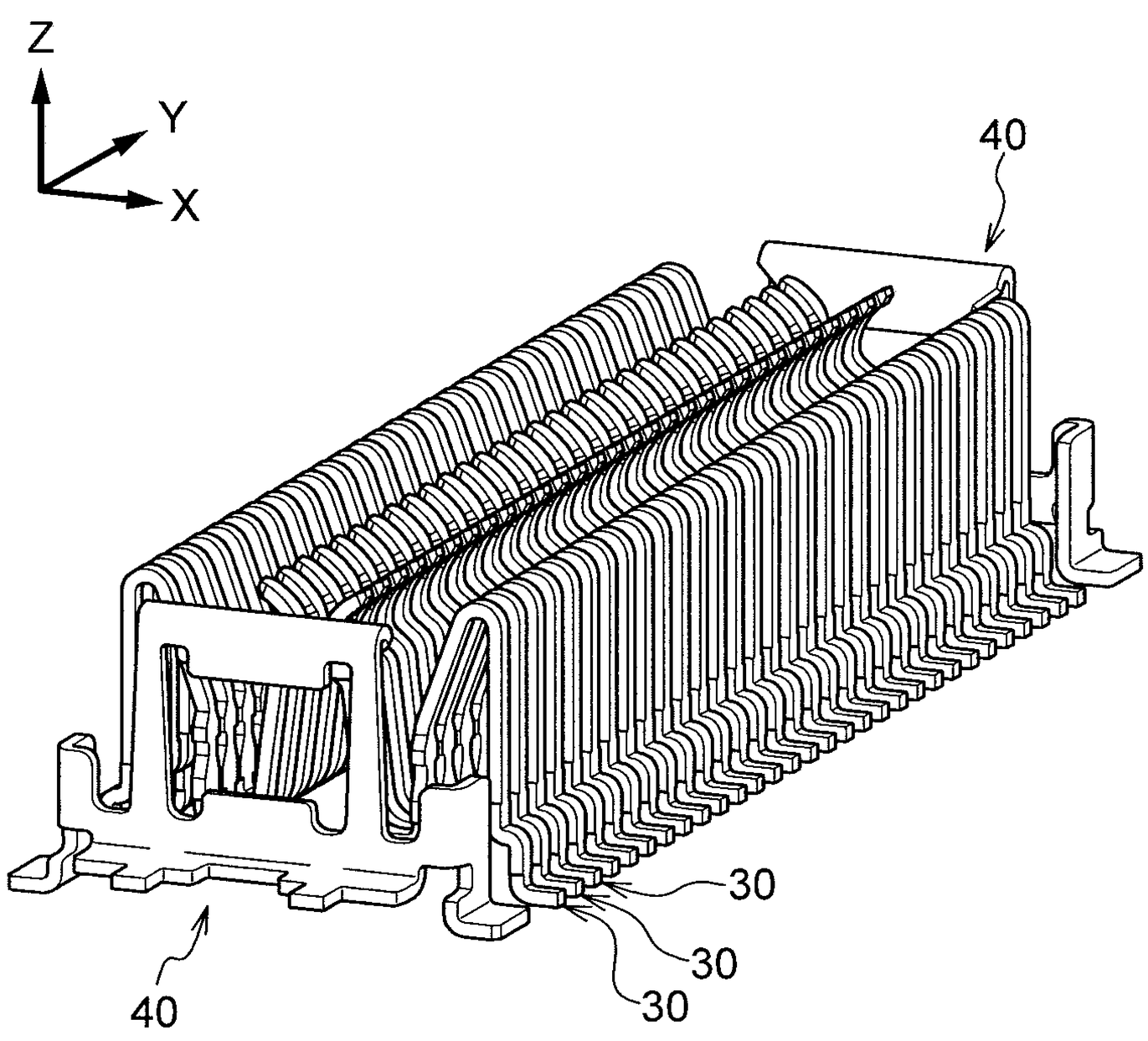


FIG.5

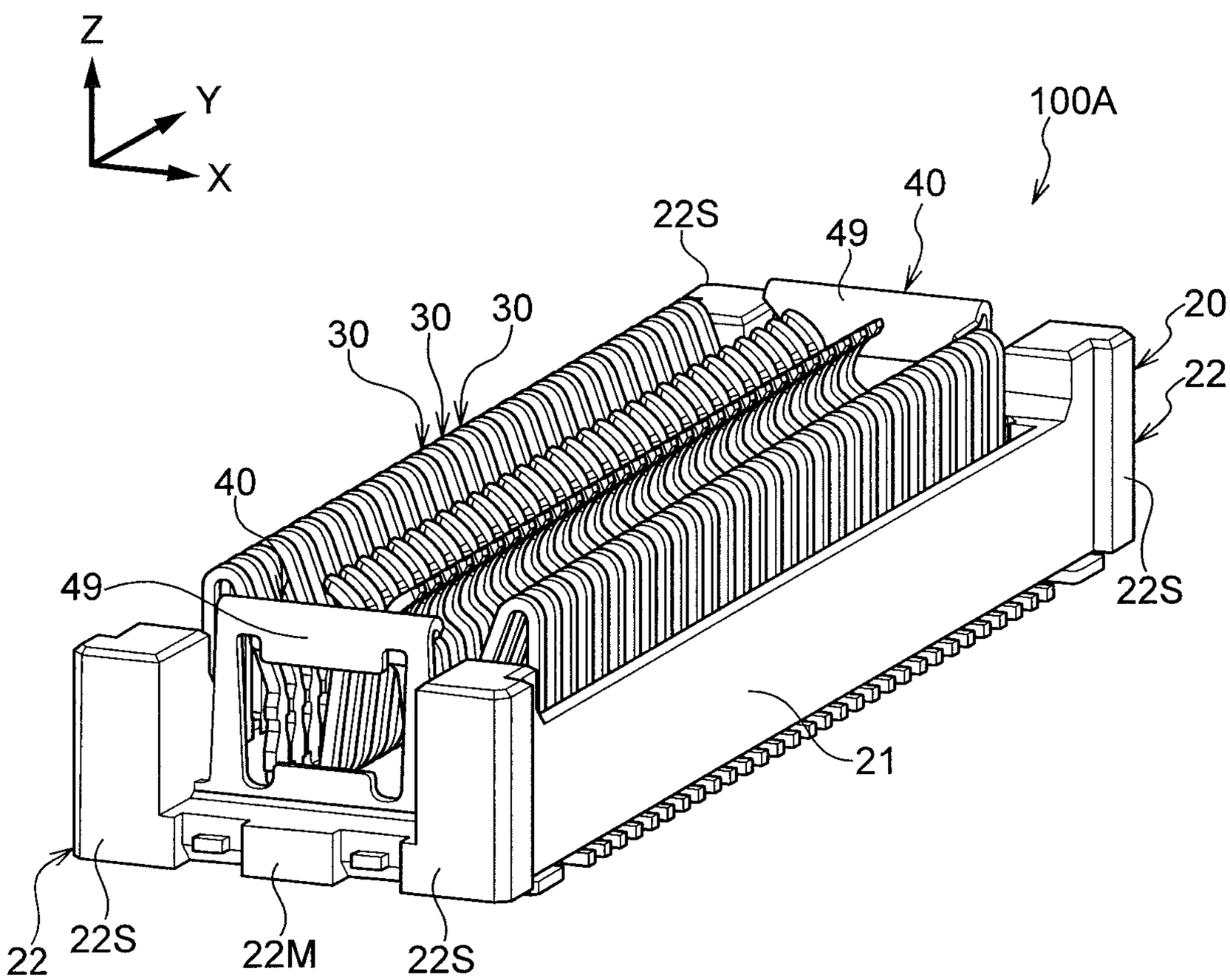


FIG.6

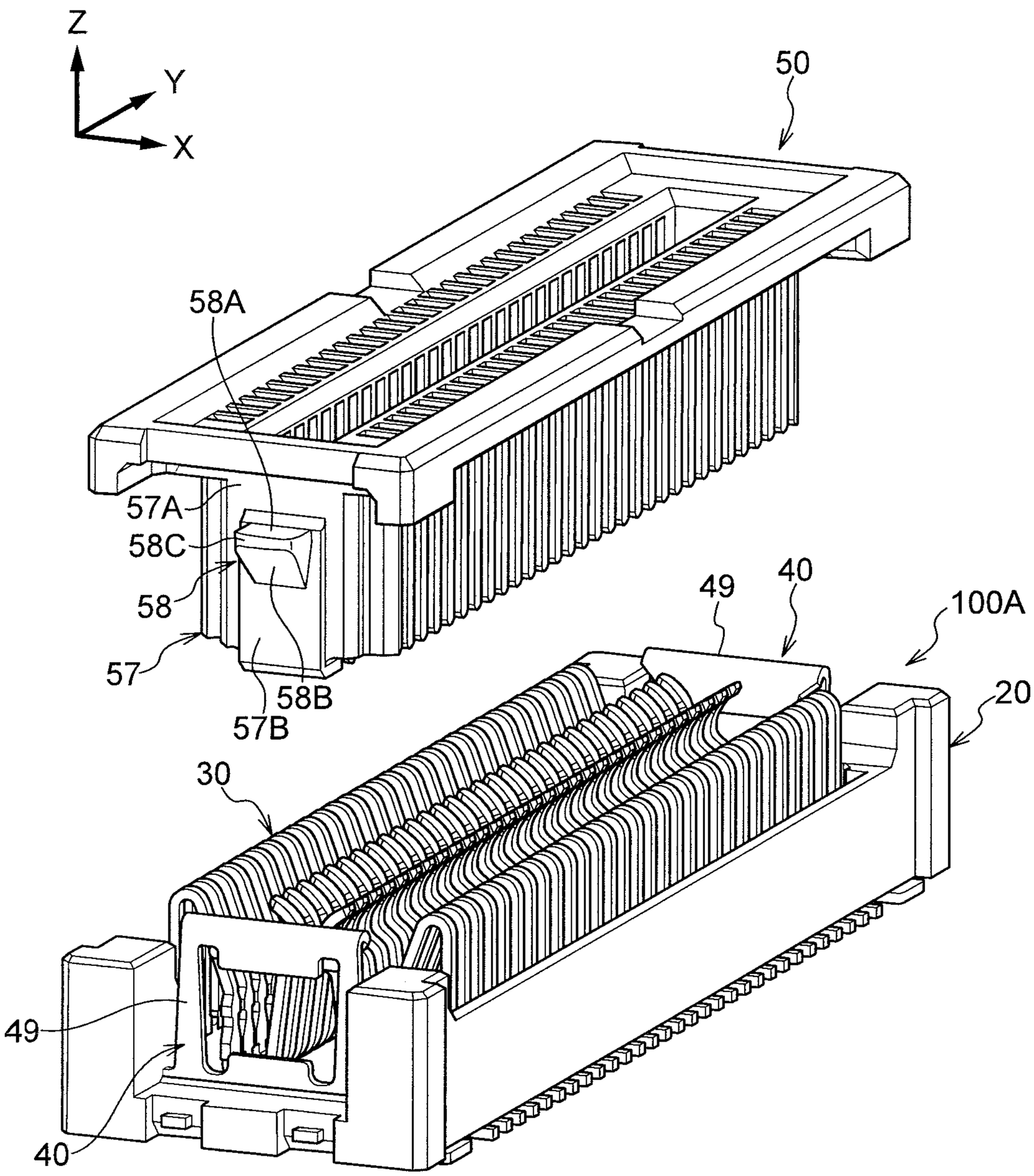


FIG.7

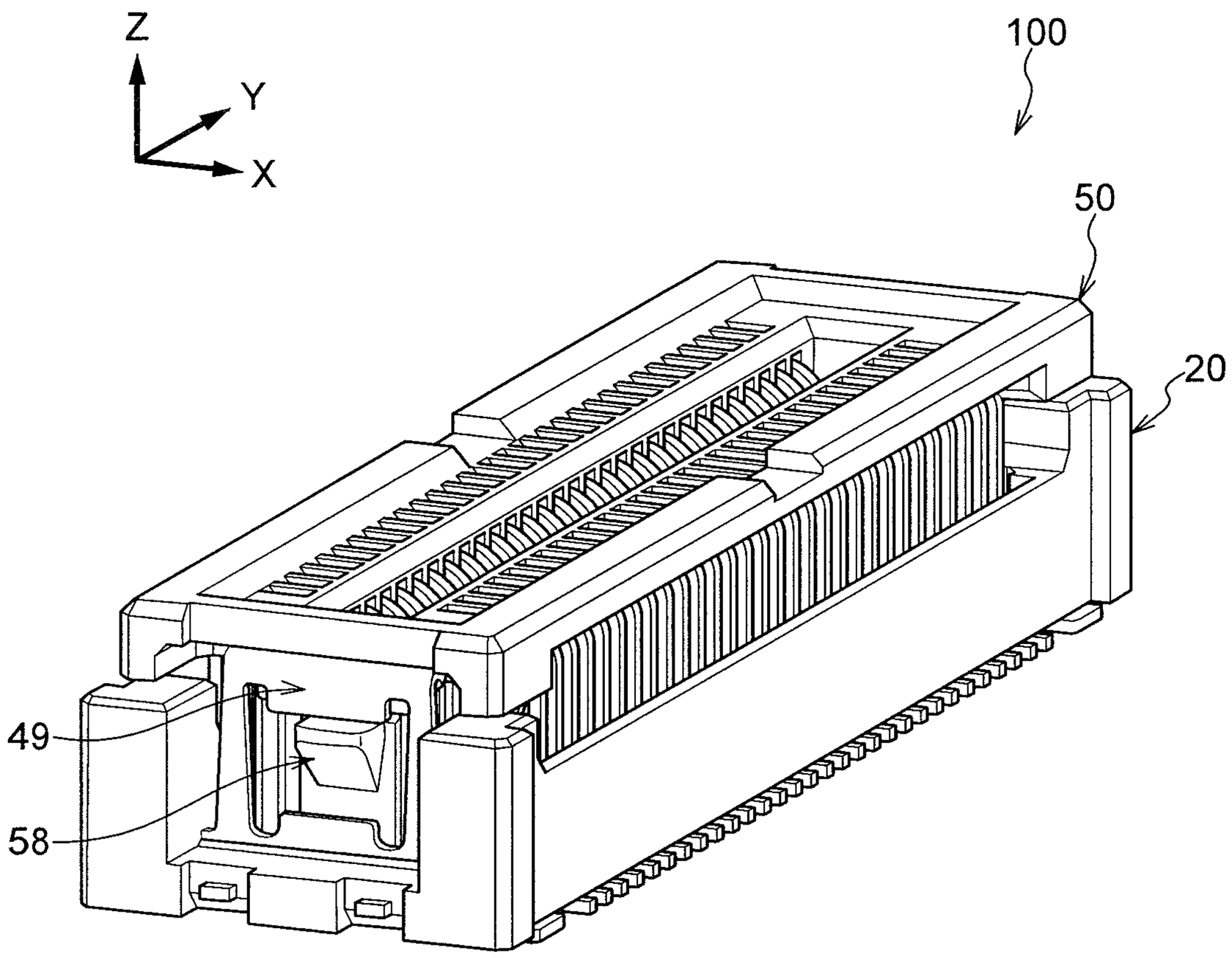
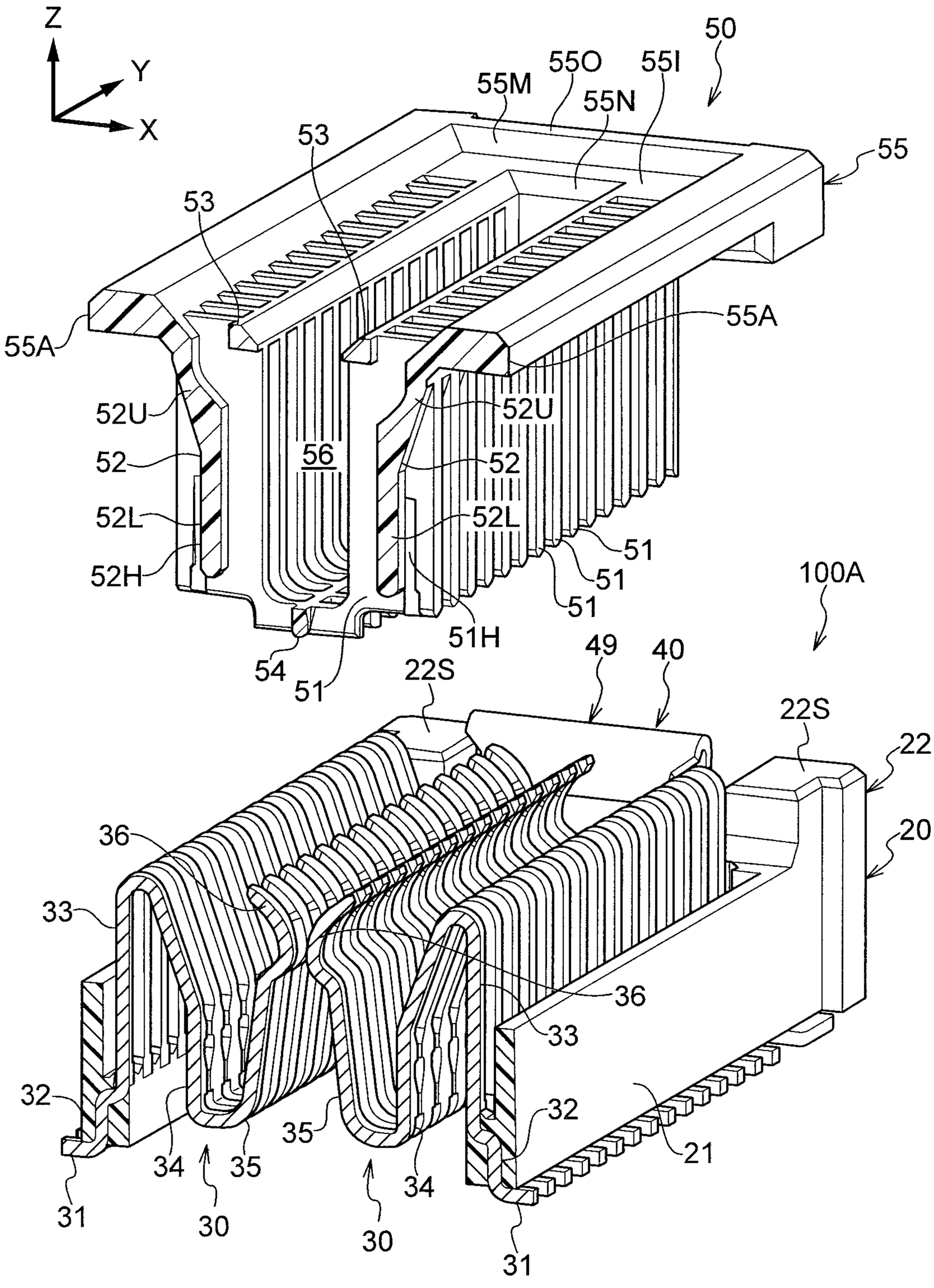


FIG.8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52H
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51
51H
54
51
100A
49
40
22S
22S
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31
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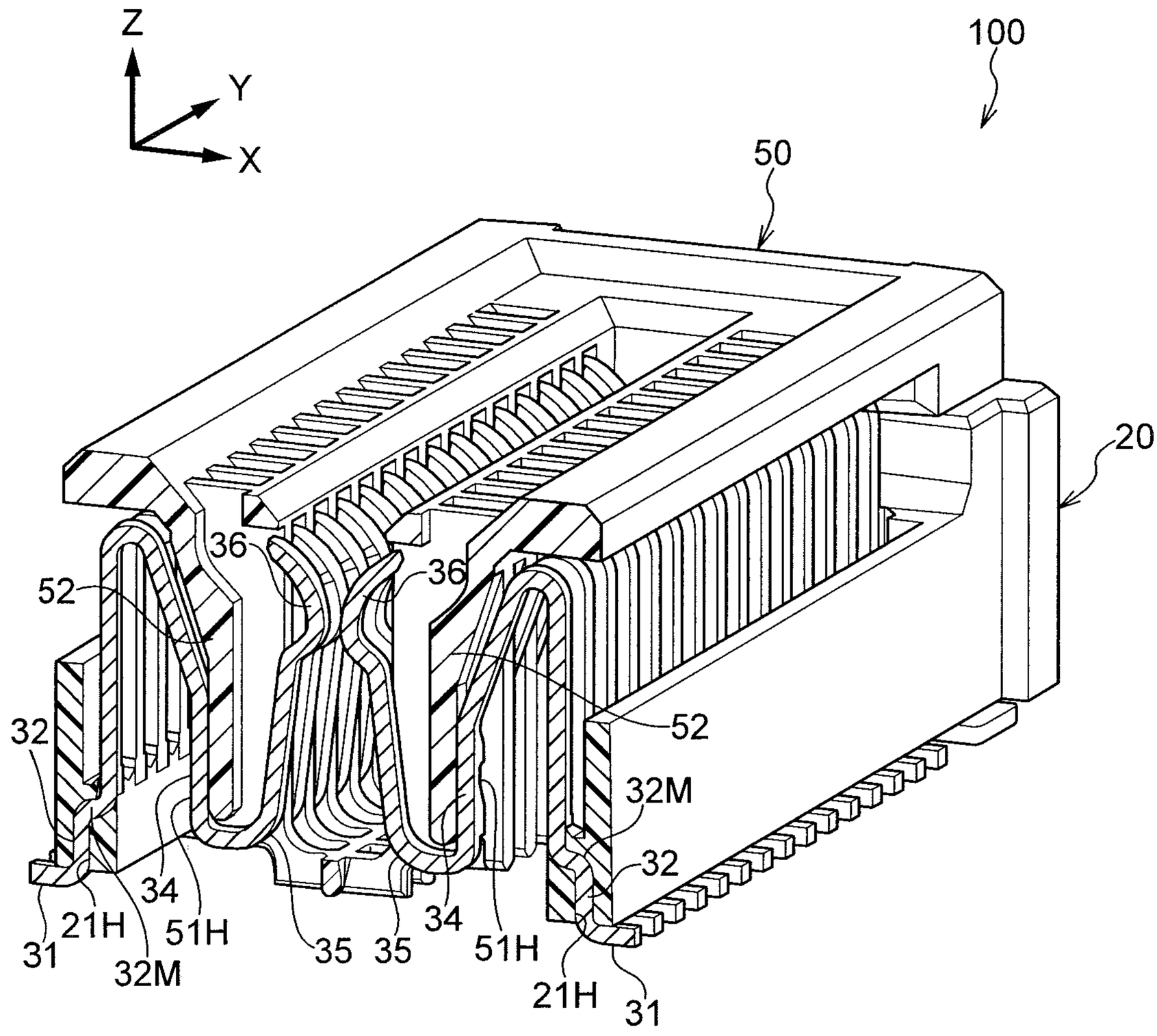
FIG.9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32M
35
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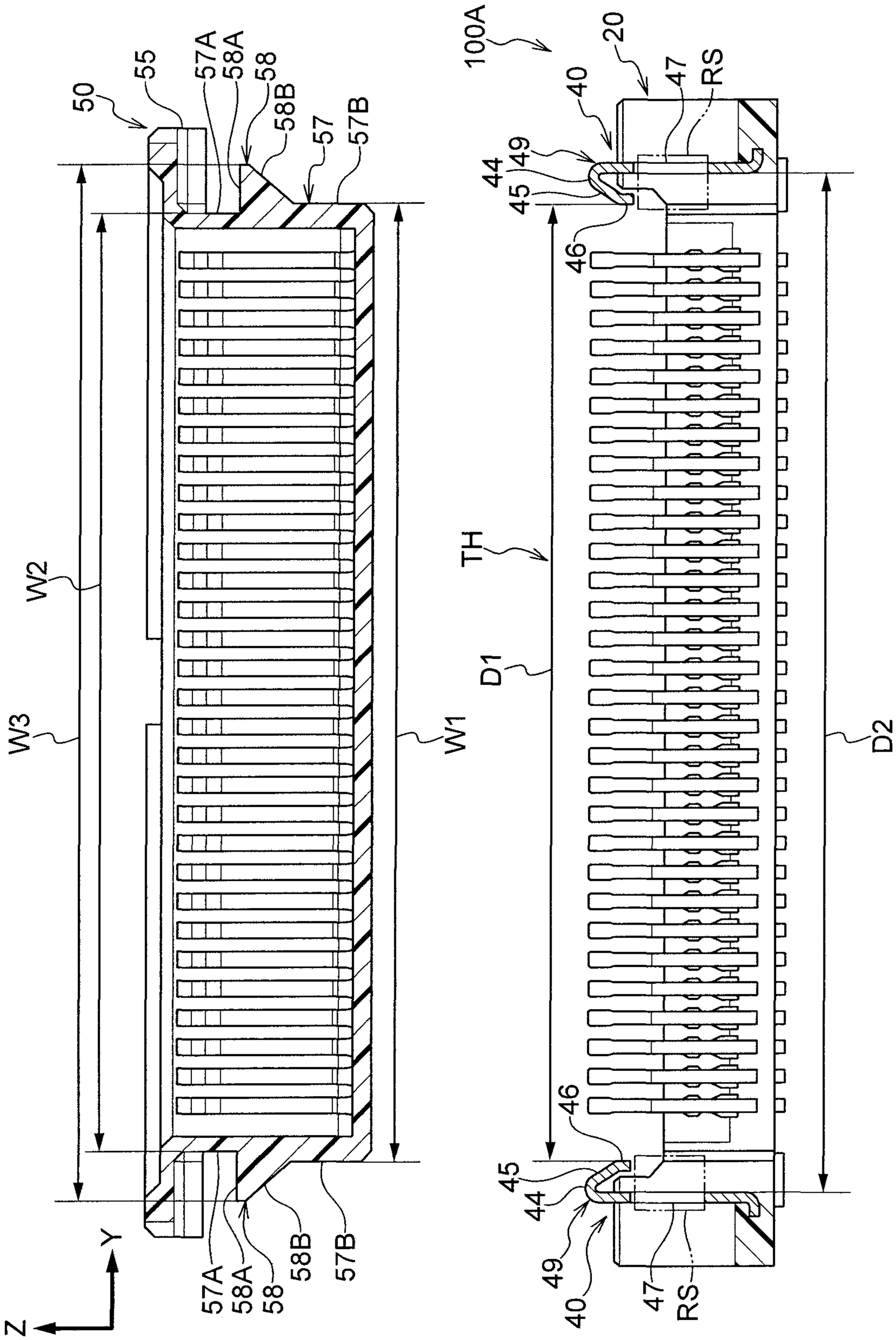
FIG.10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58A
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58B
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57B
W2
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W1
Y
Z
100A
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46
TH
D1
D2

FIG.11A

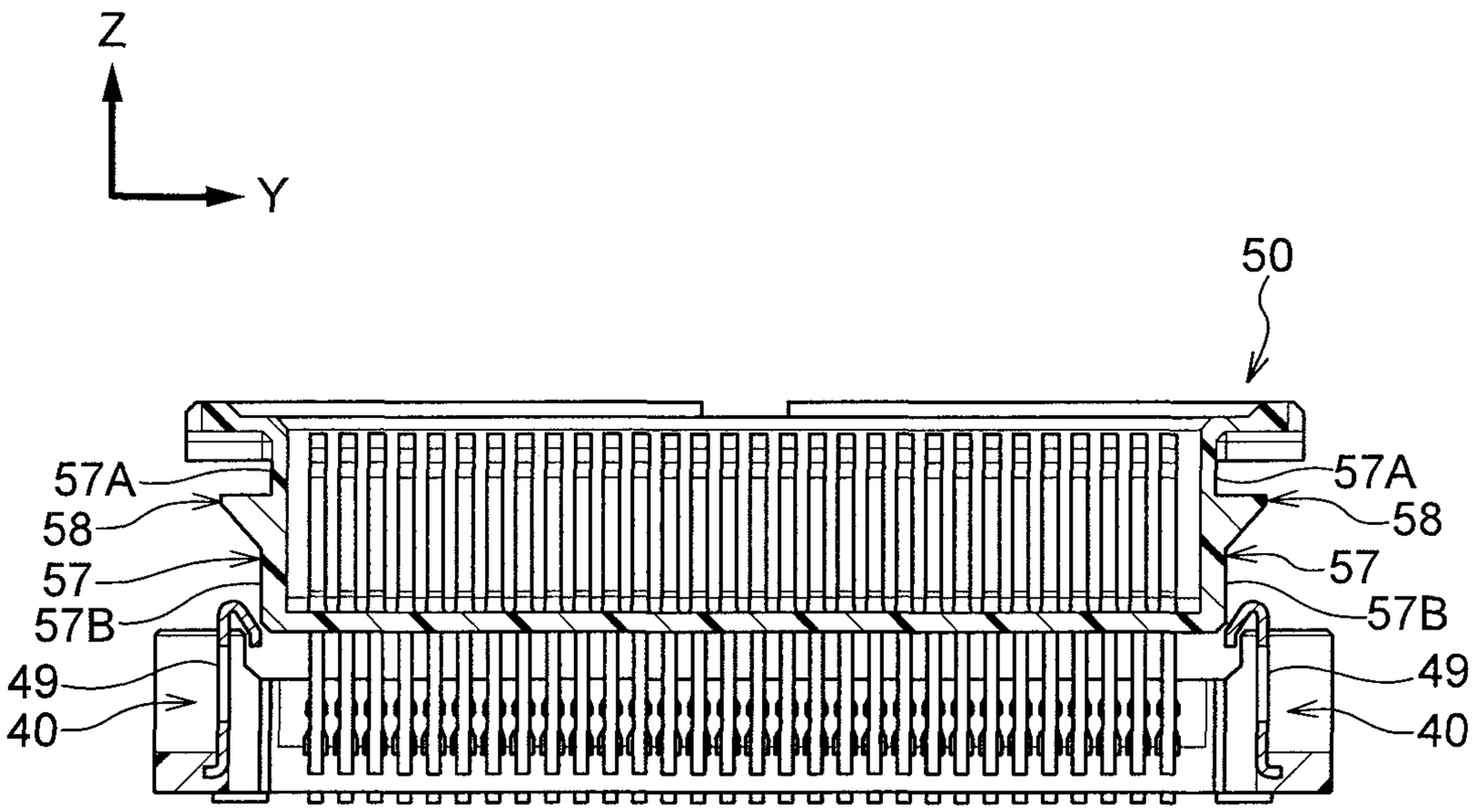


FIG.11B

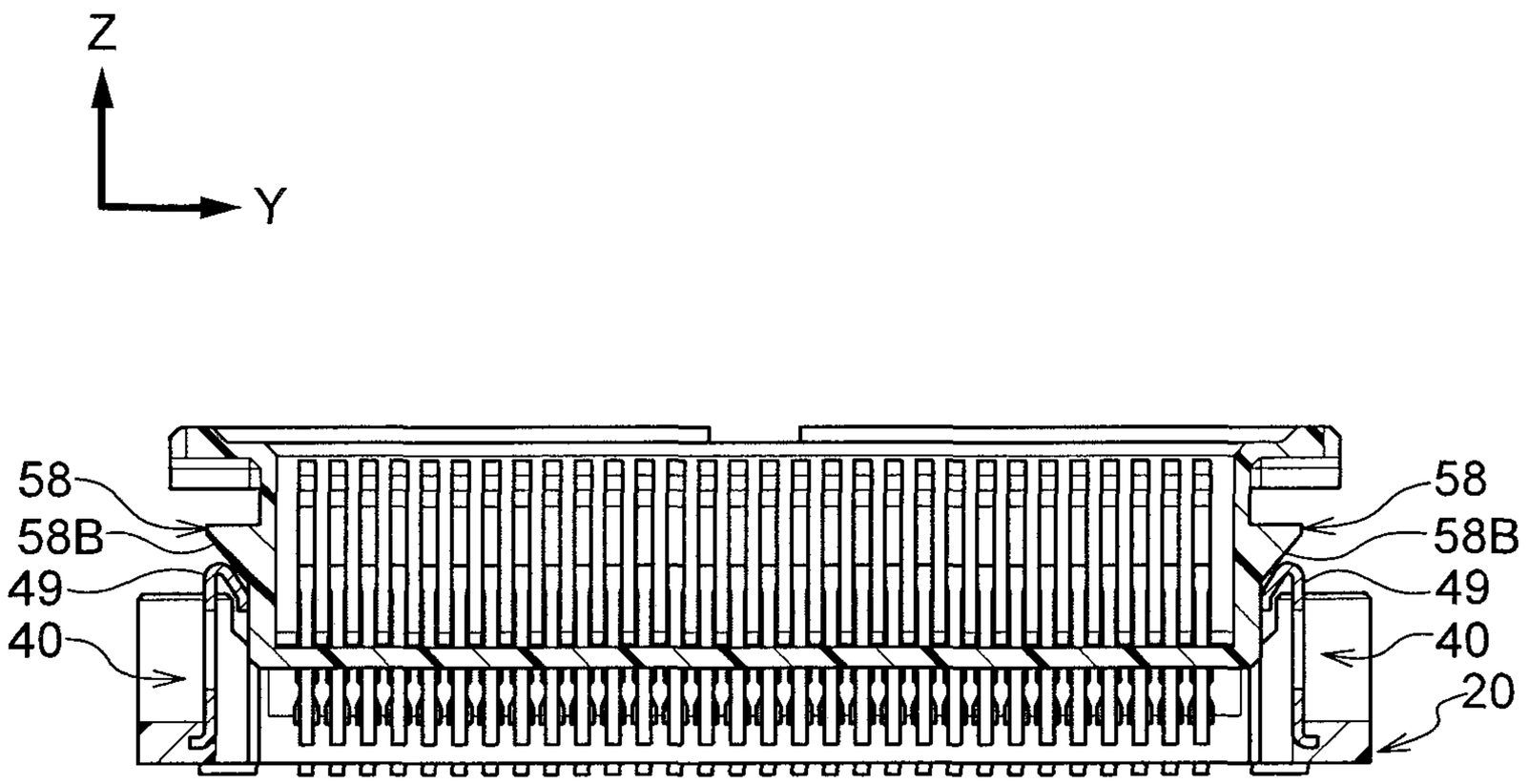


FIG.11C

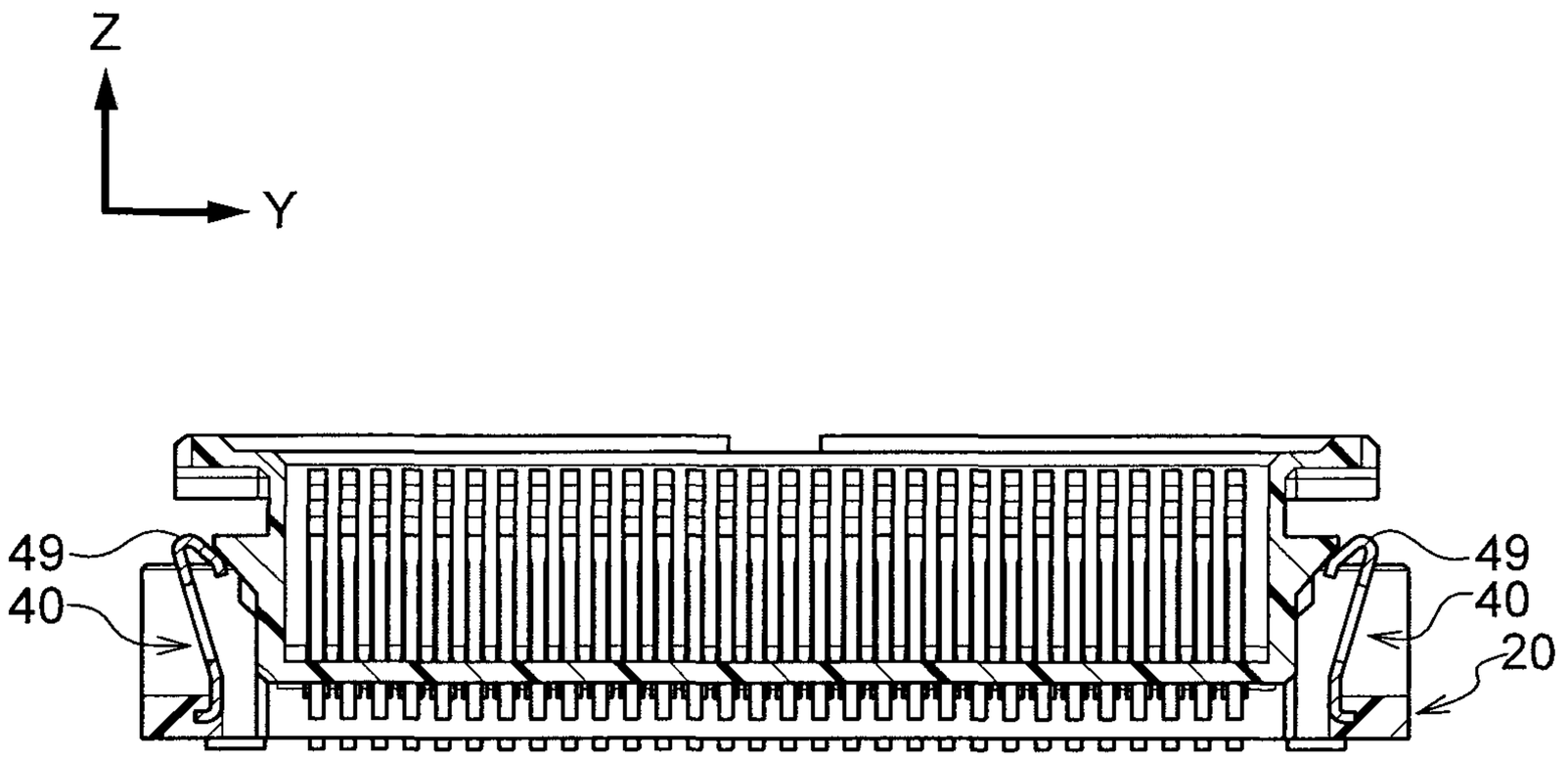


FIG.11D

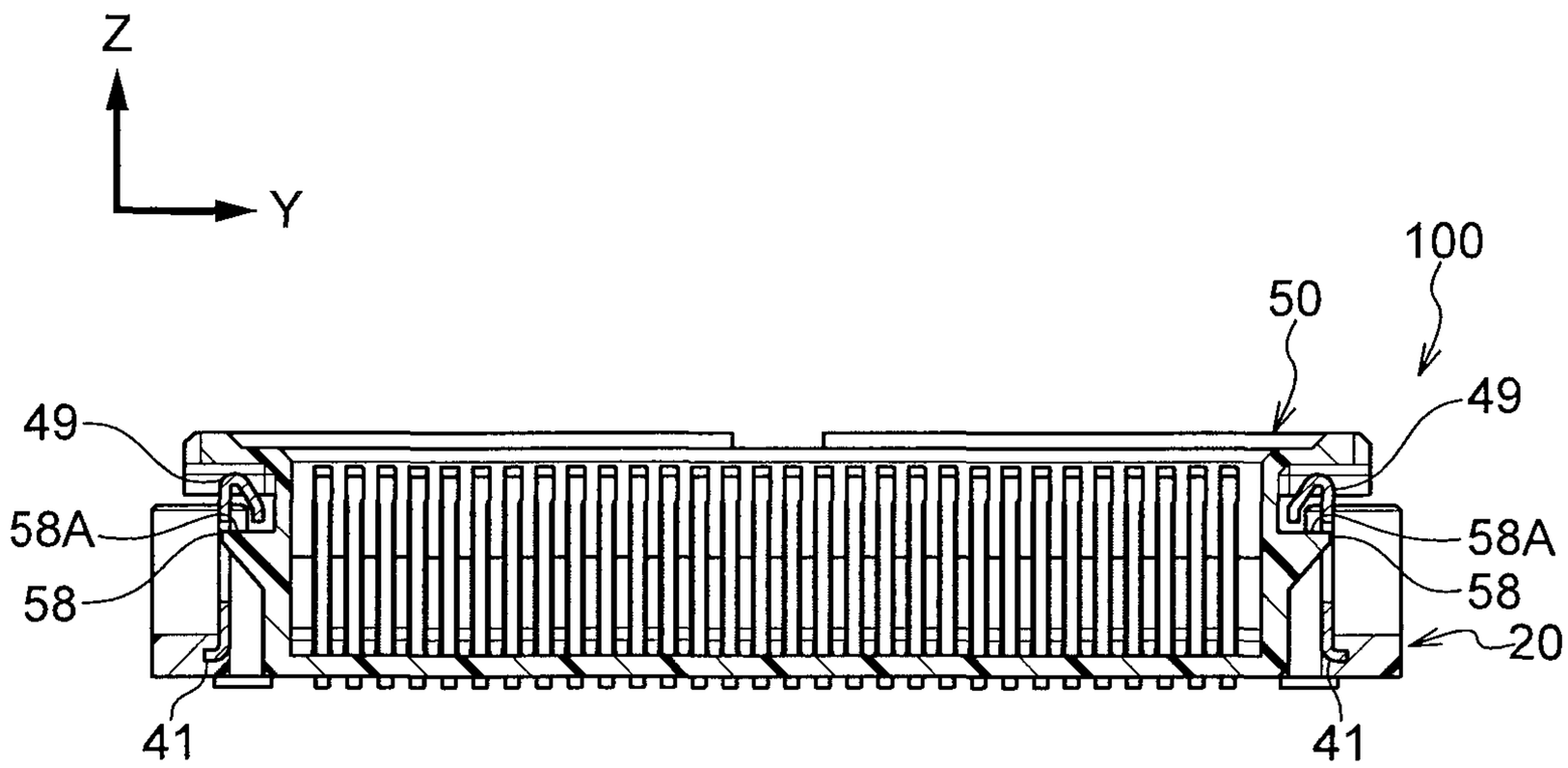
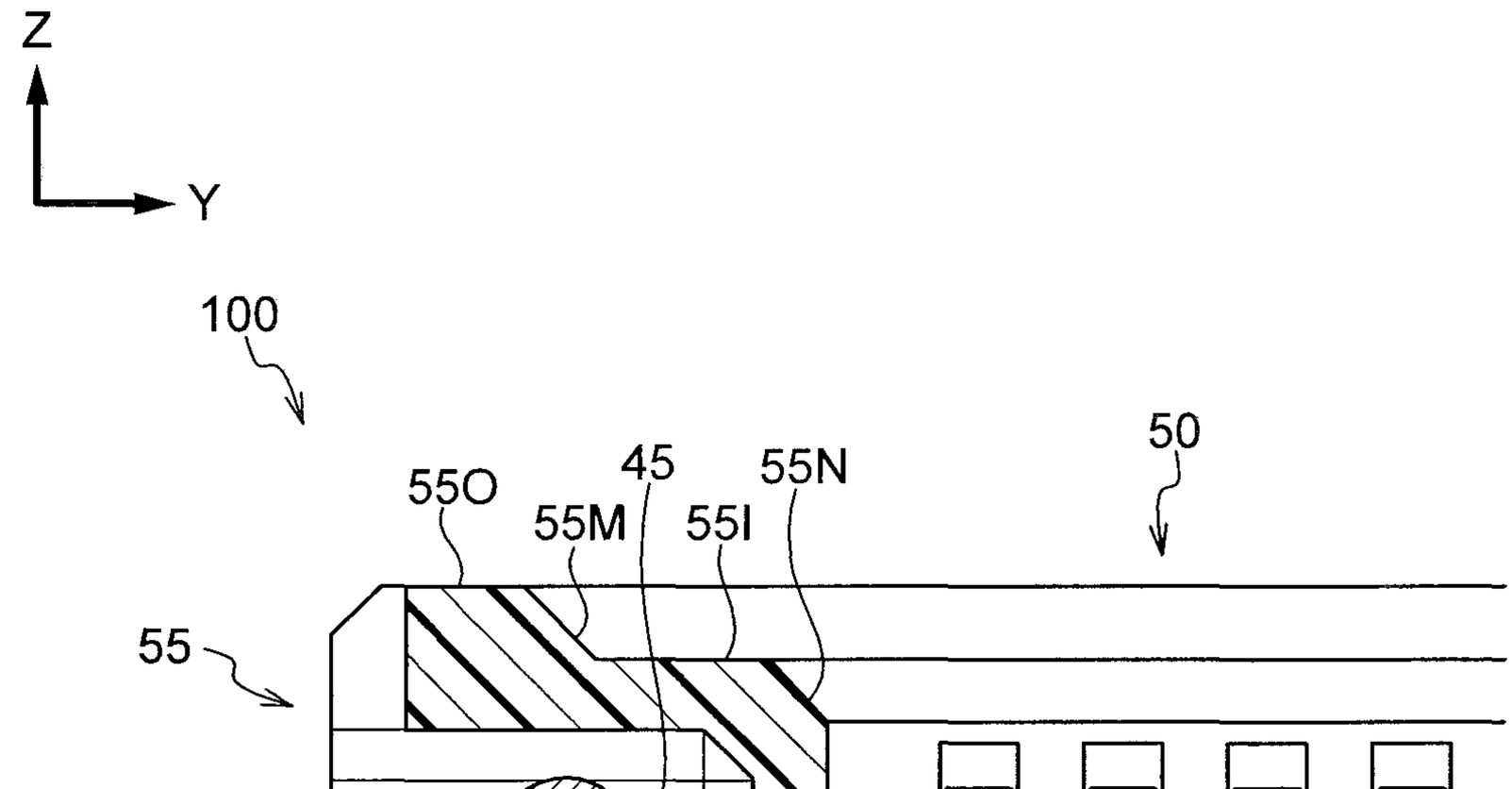


FIG.12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50
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55I
55N
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44
57A
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(48)
46
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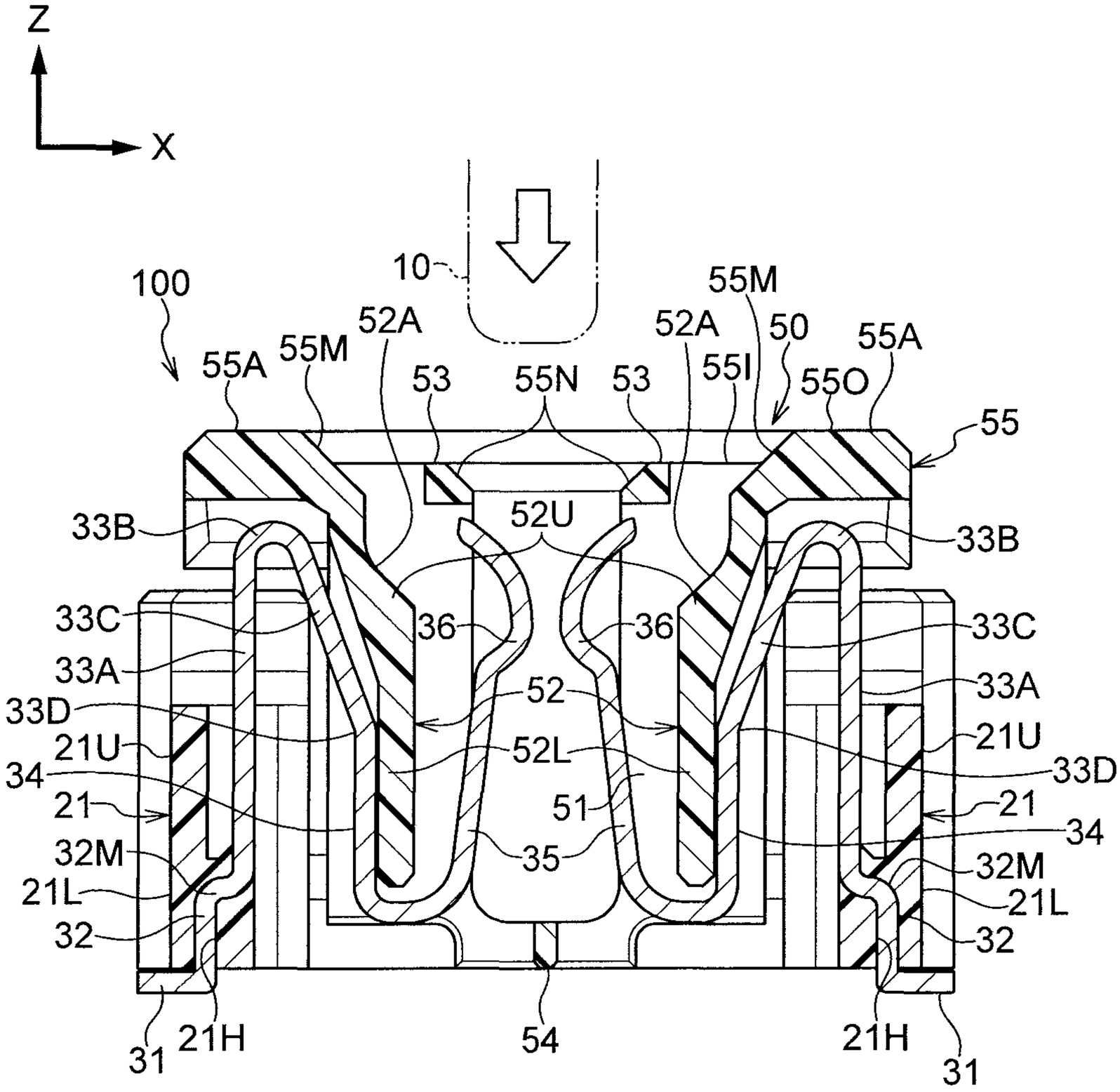
(48)
58A
58B
47
56
20
40
58
22
57
57B
22H
41

FIG.13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55N
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52A
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50
55O
55A
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33B
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33B
33C
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36
33C
33A
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33A
33D
21U
52L
21U
34
51
33D
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32M
35
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21L
32M
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21L
32
31
21H
54
21H
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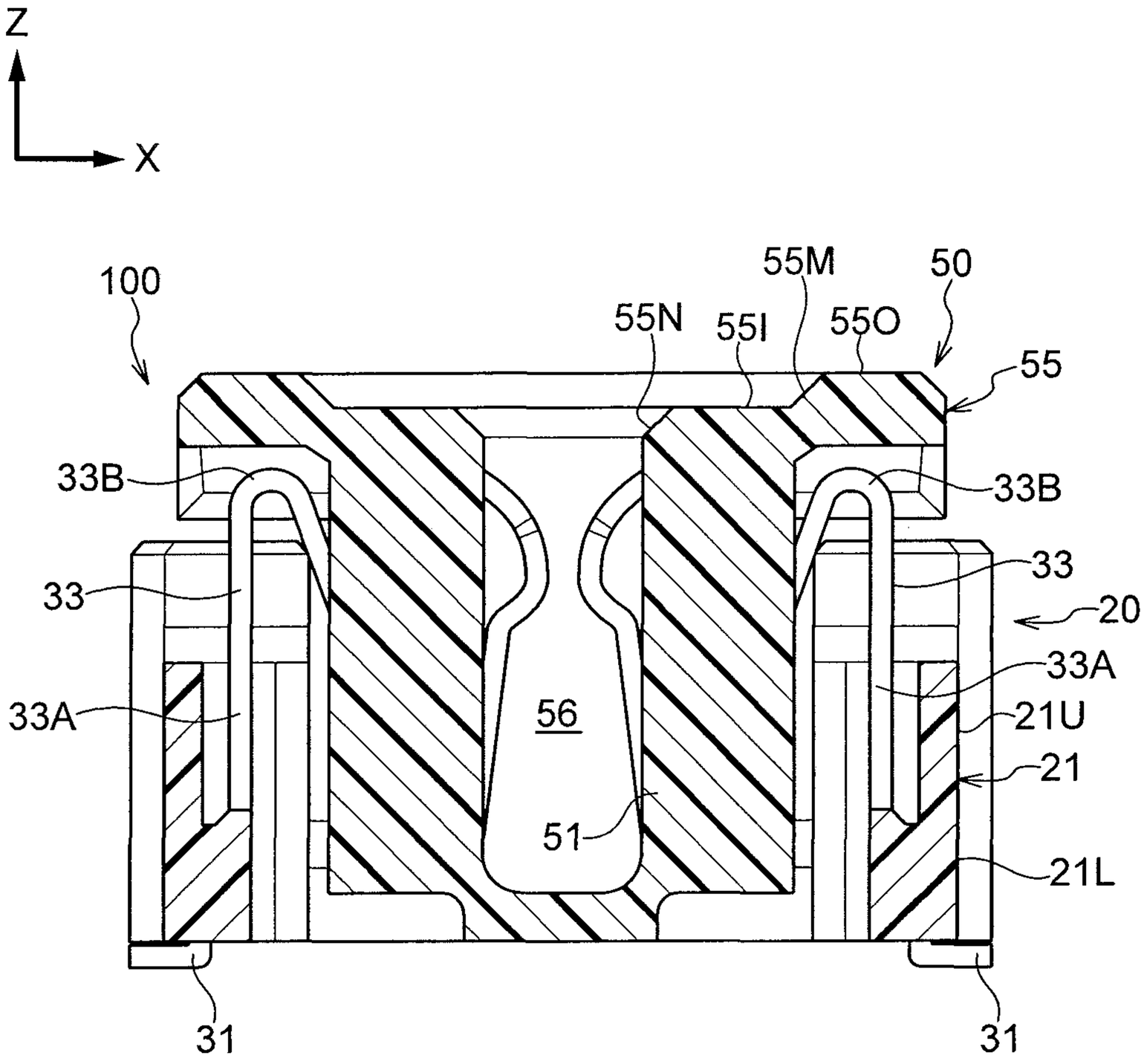
FIG.14


Z
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21
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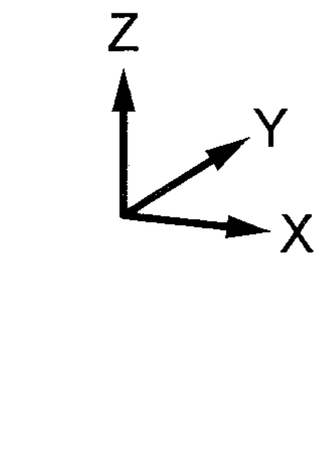
21L
31
31

FIG.15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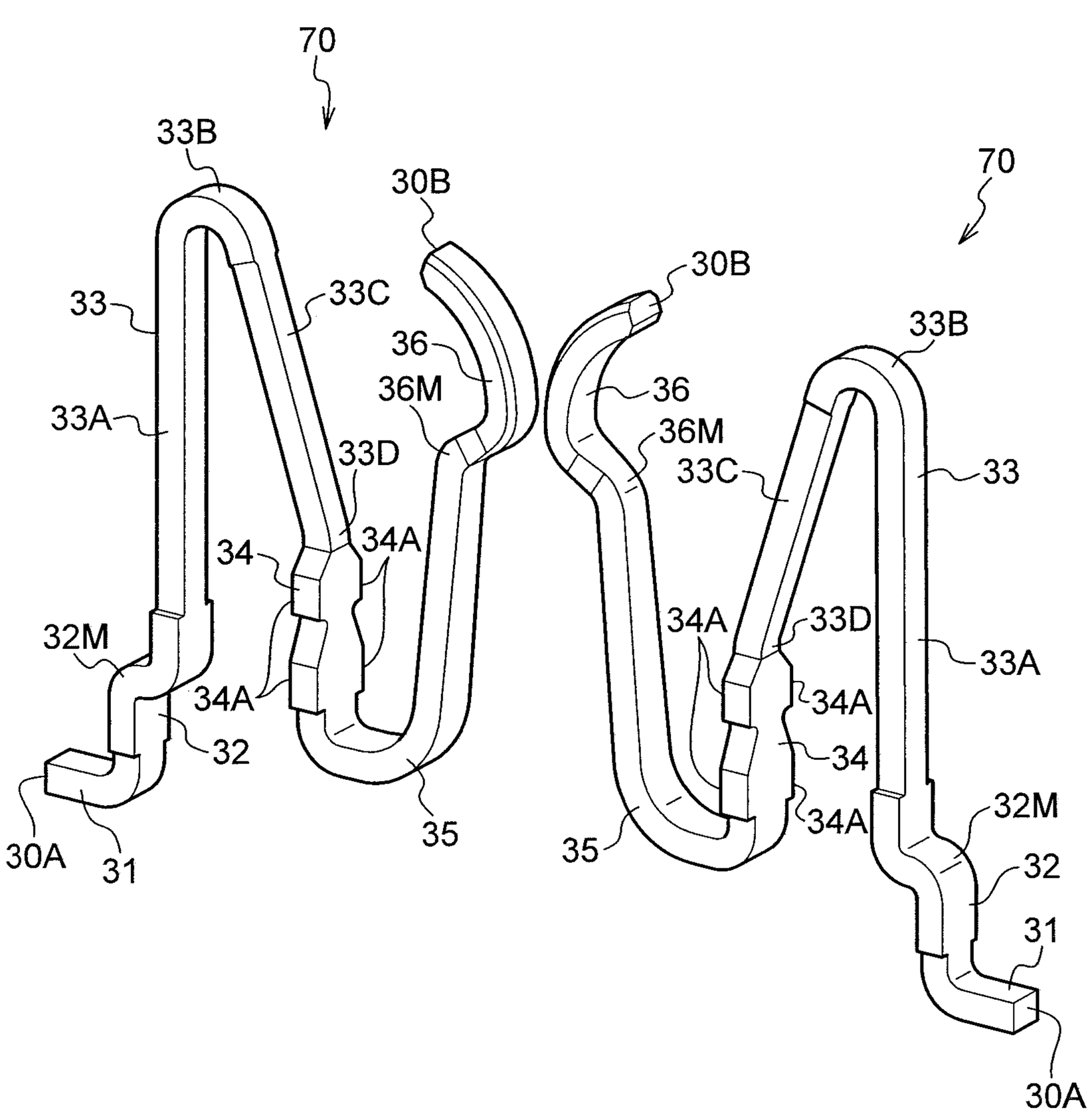
70
33B
30B
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33C
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36M
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32M
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30A
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35
70
30B
33B
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34A
33D
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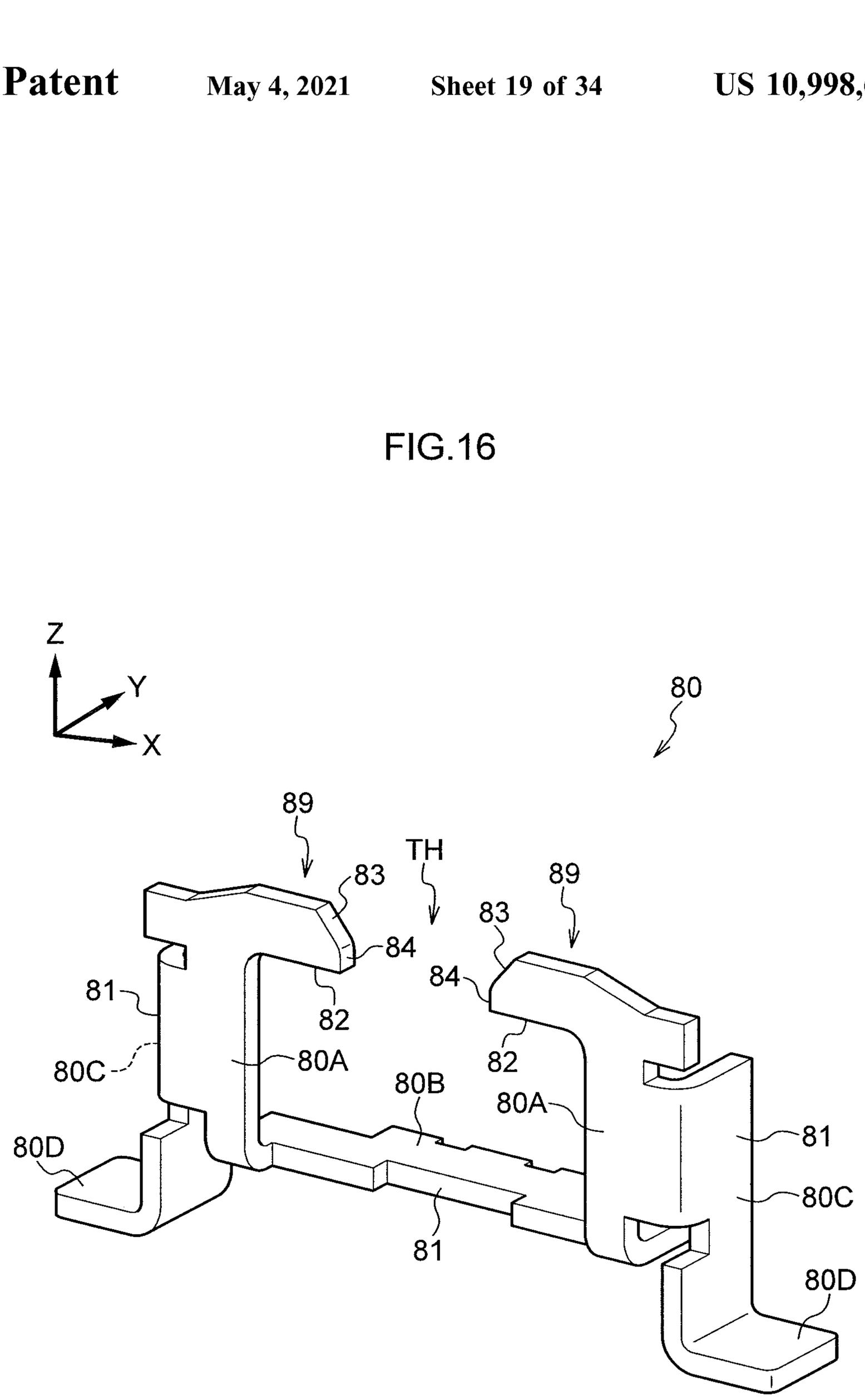
34A
32M
35
32
31
30A

FIG.16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80D

FIG.17

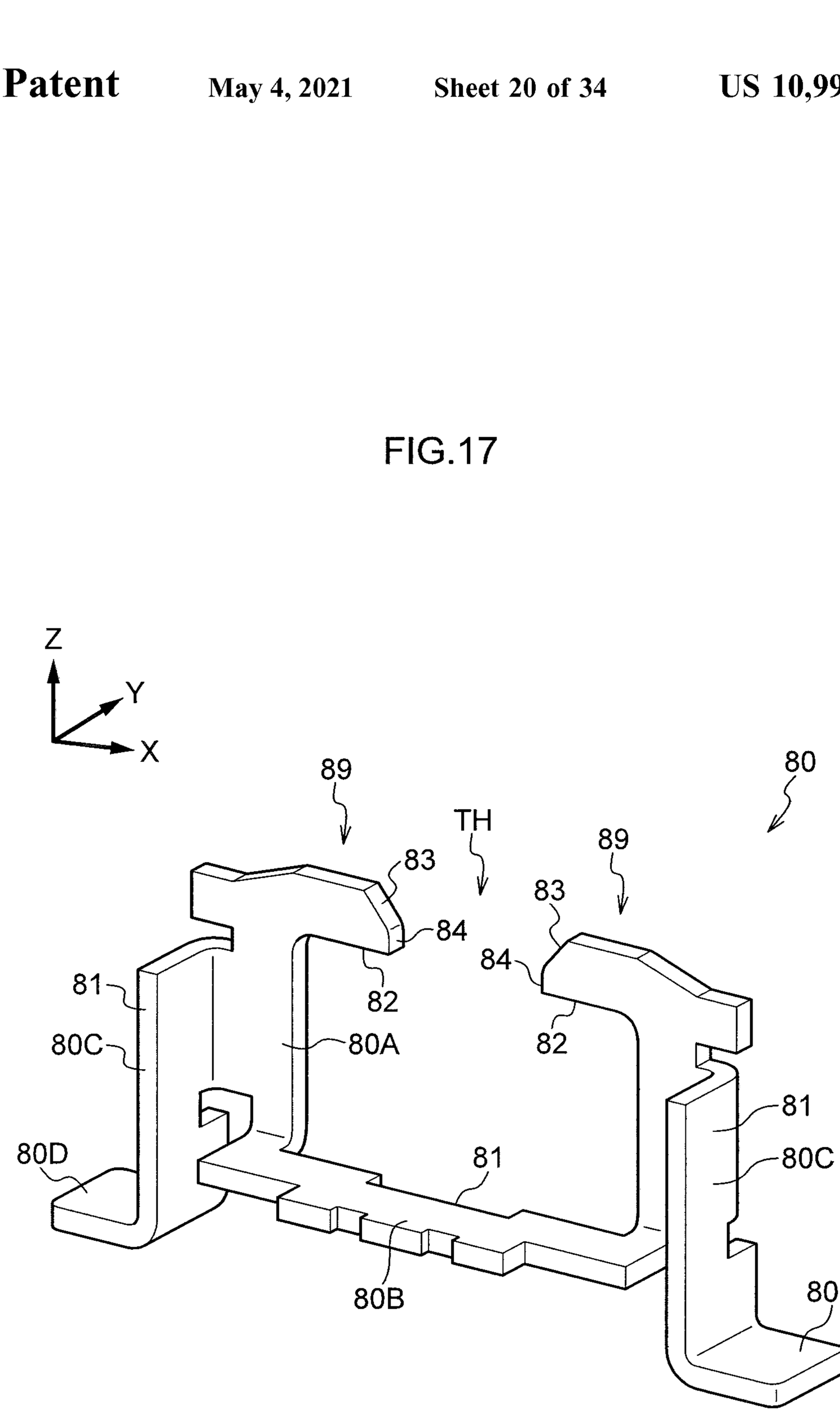


FIG.18

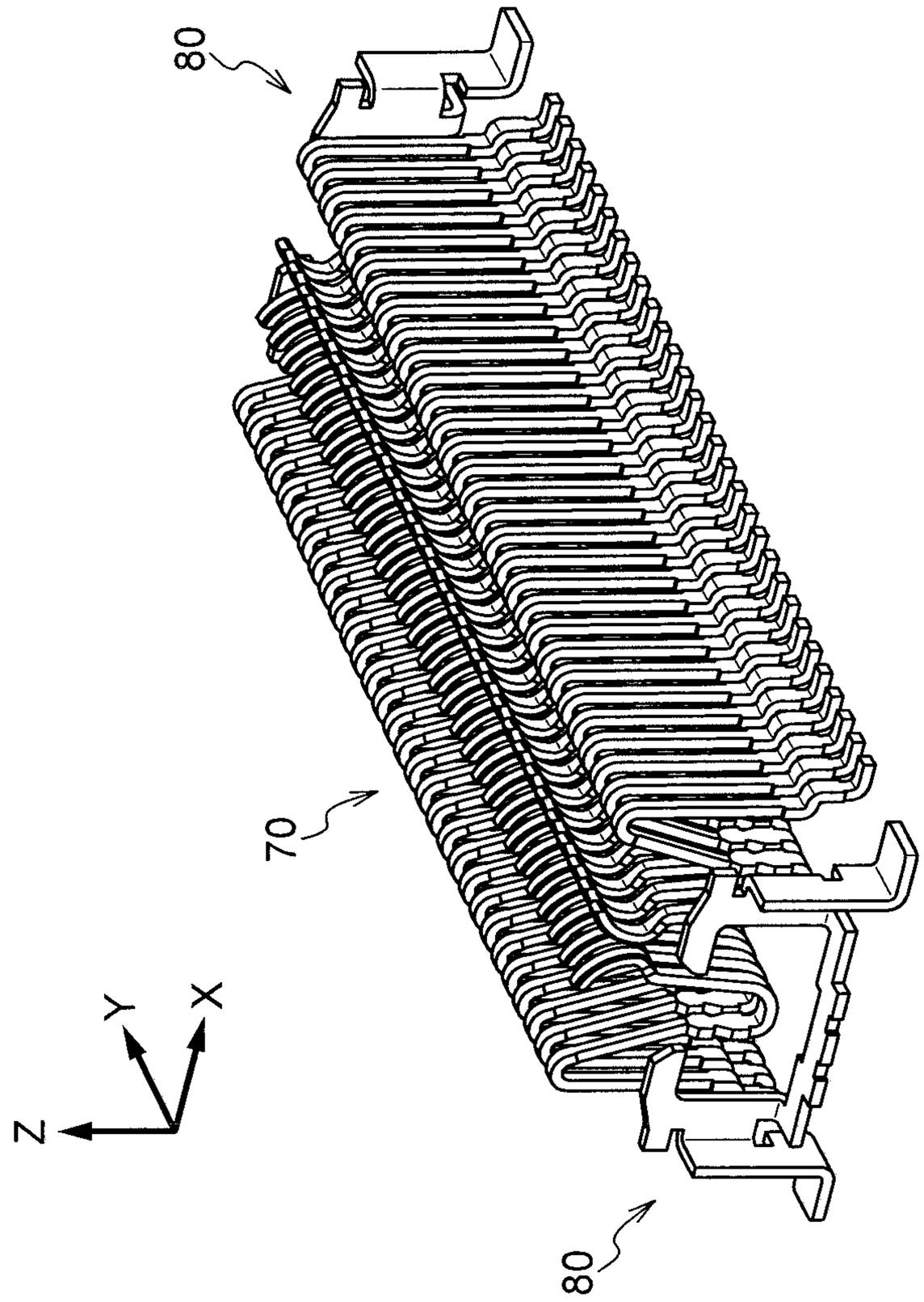


FIG.19

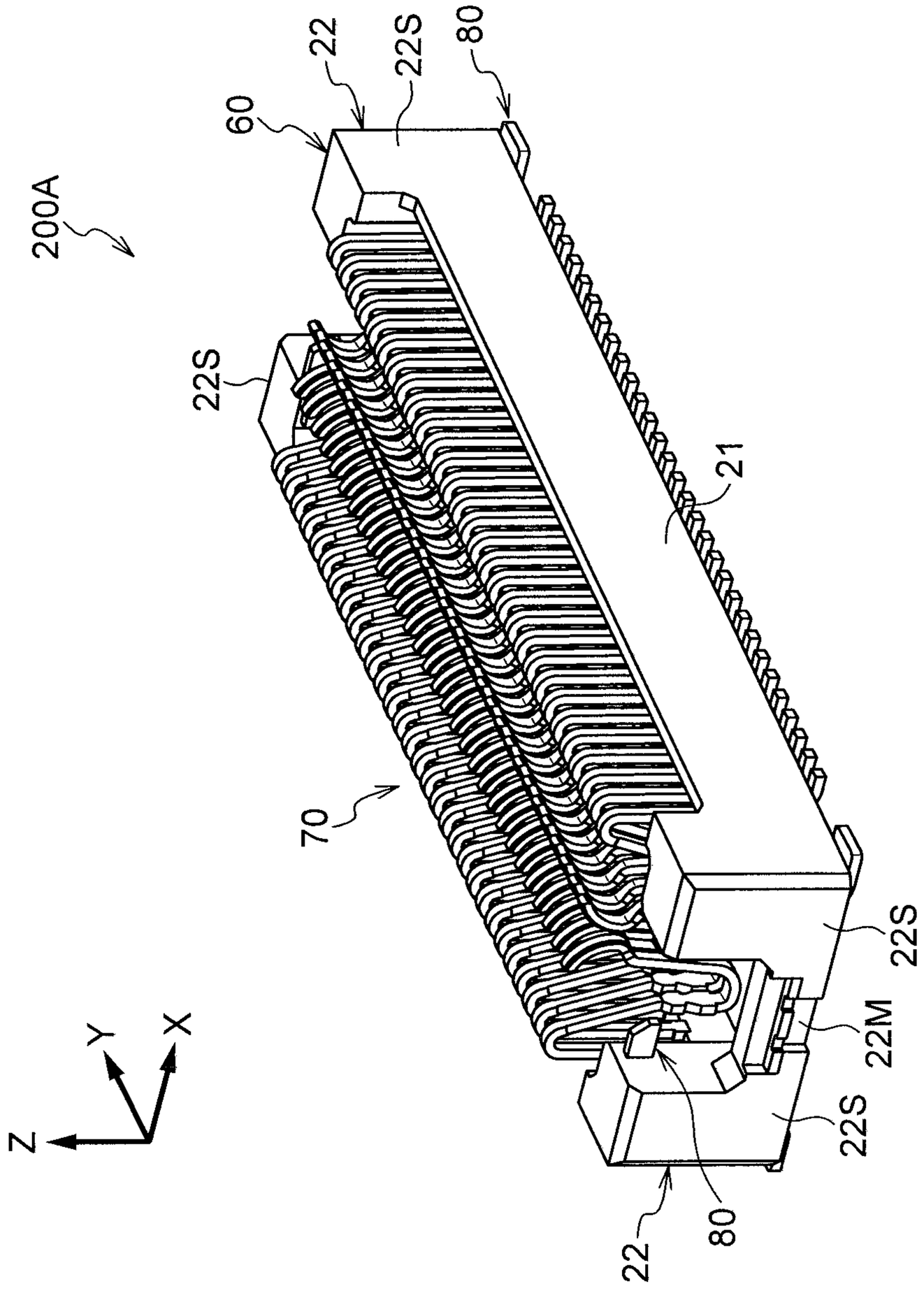


FIG.20

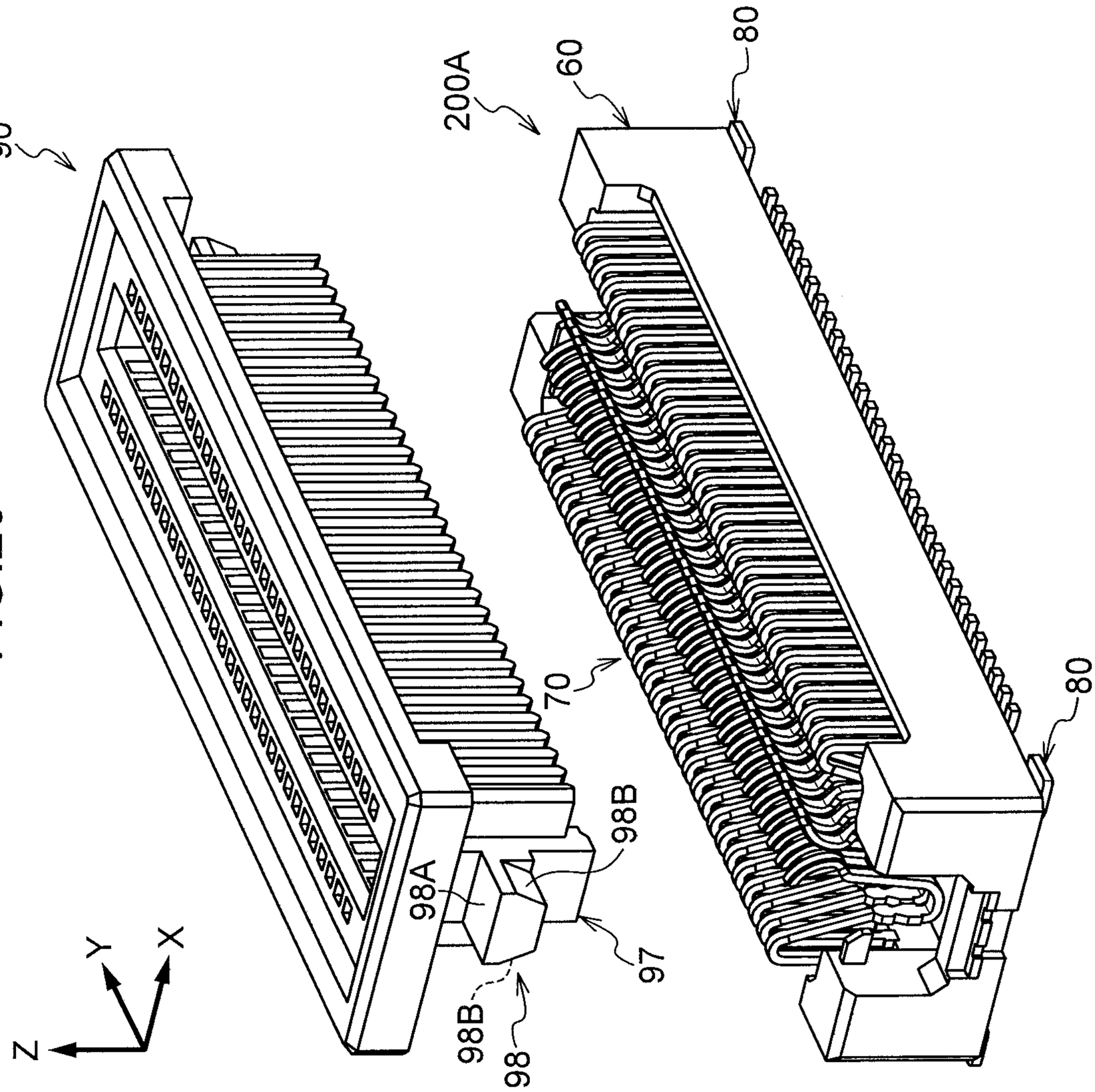


FIG.21

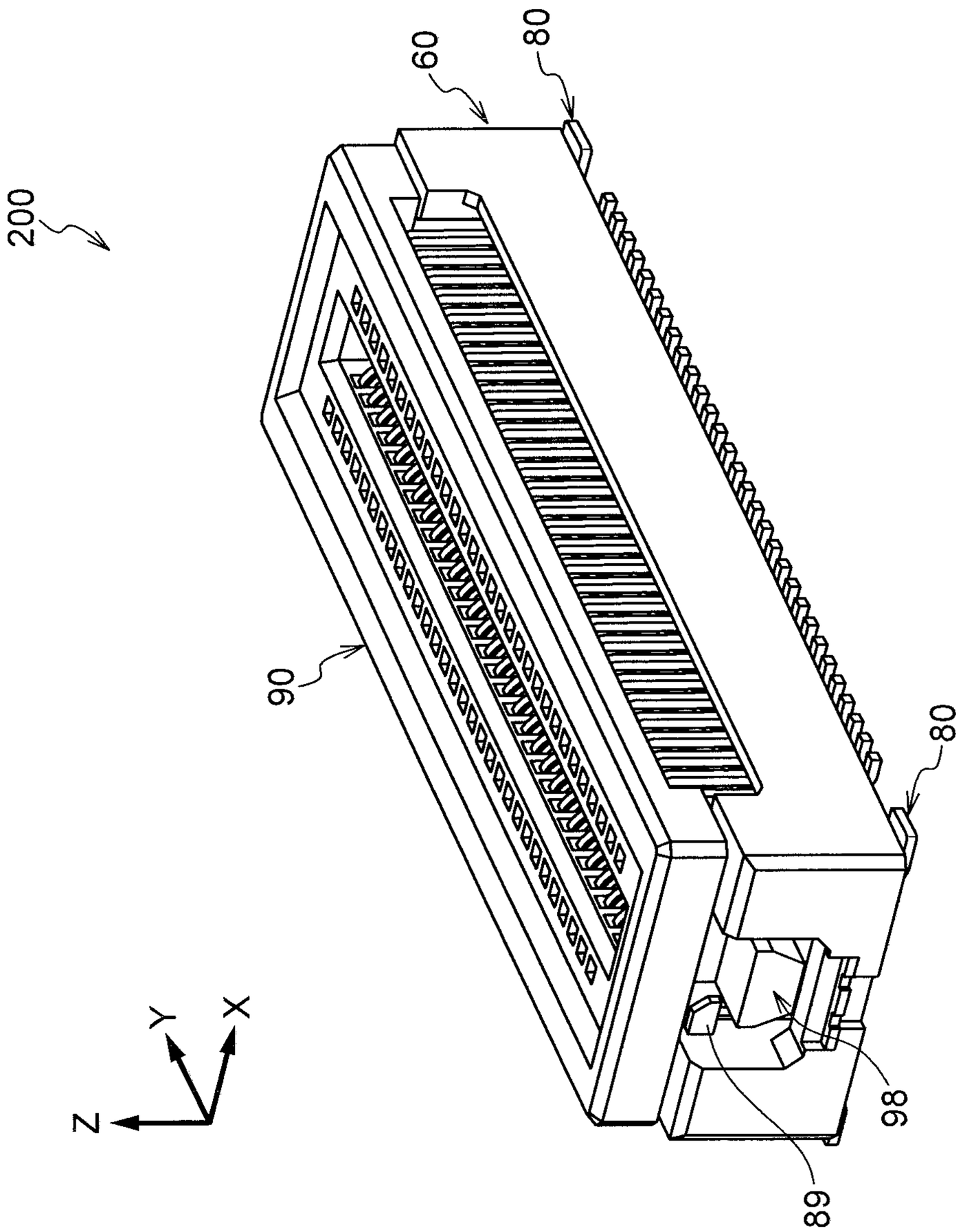
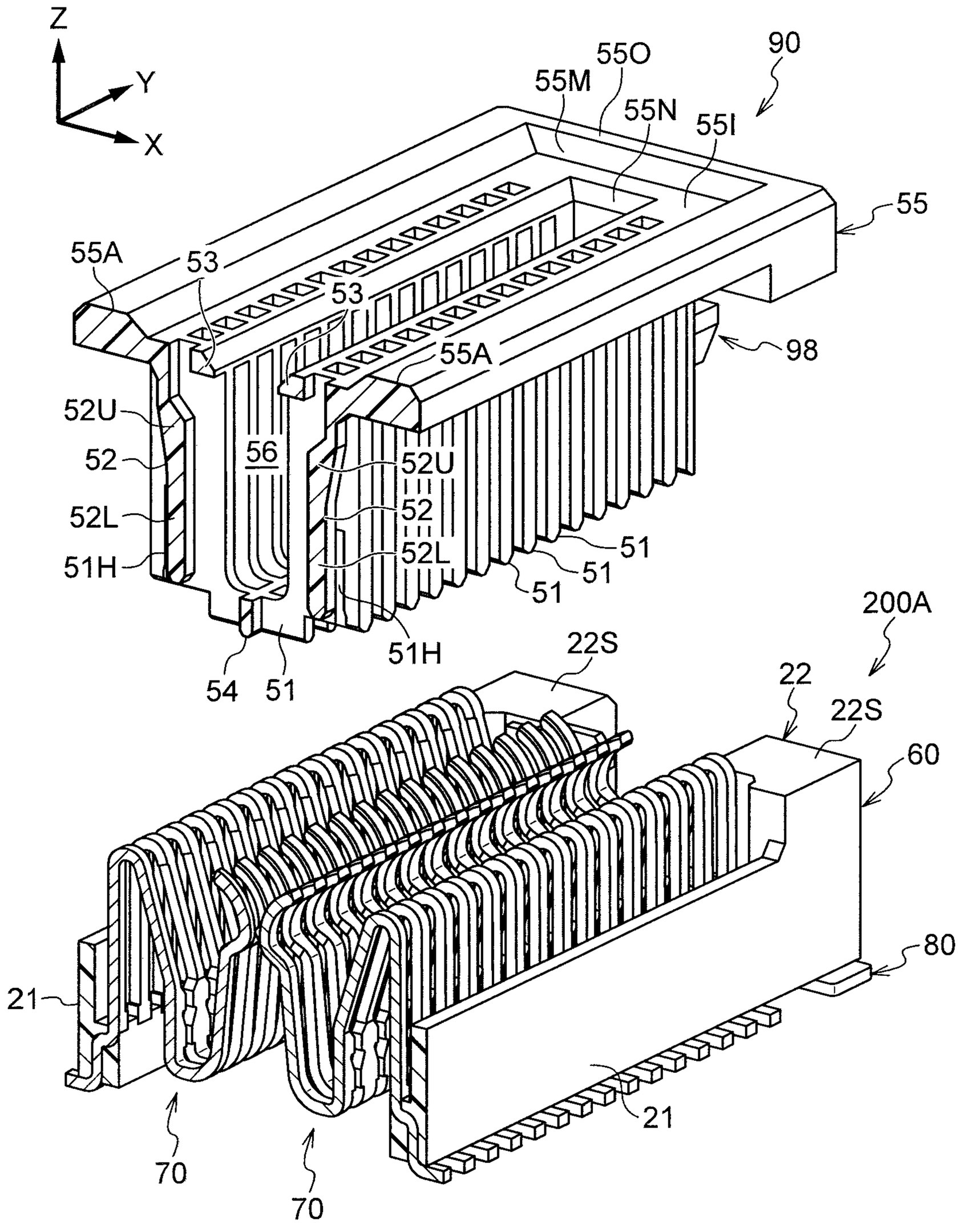


FIG.22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52U
52L
52
51H
52L
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51H
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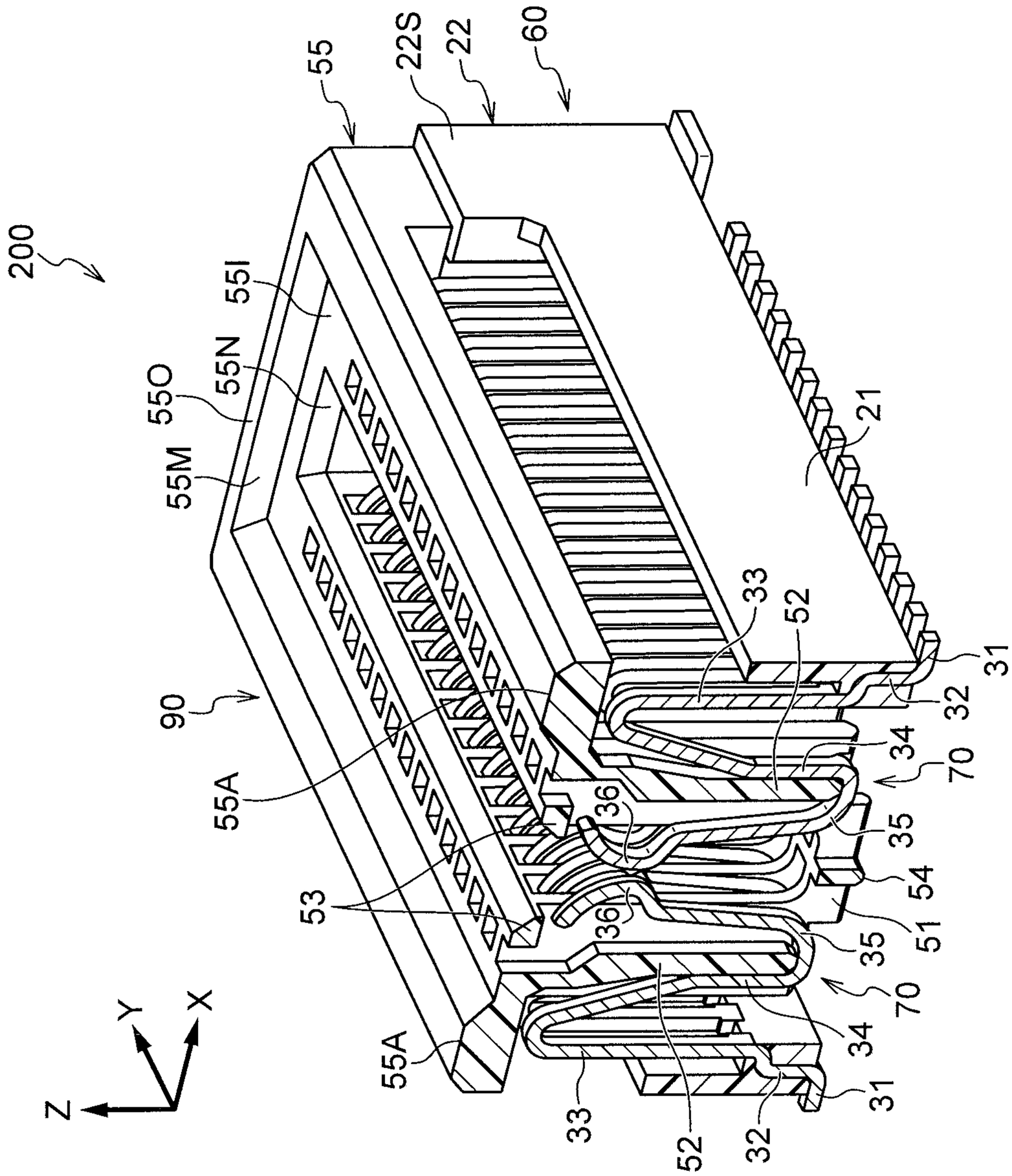
FIG.23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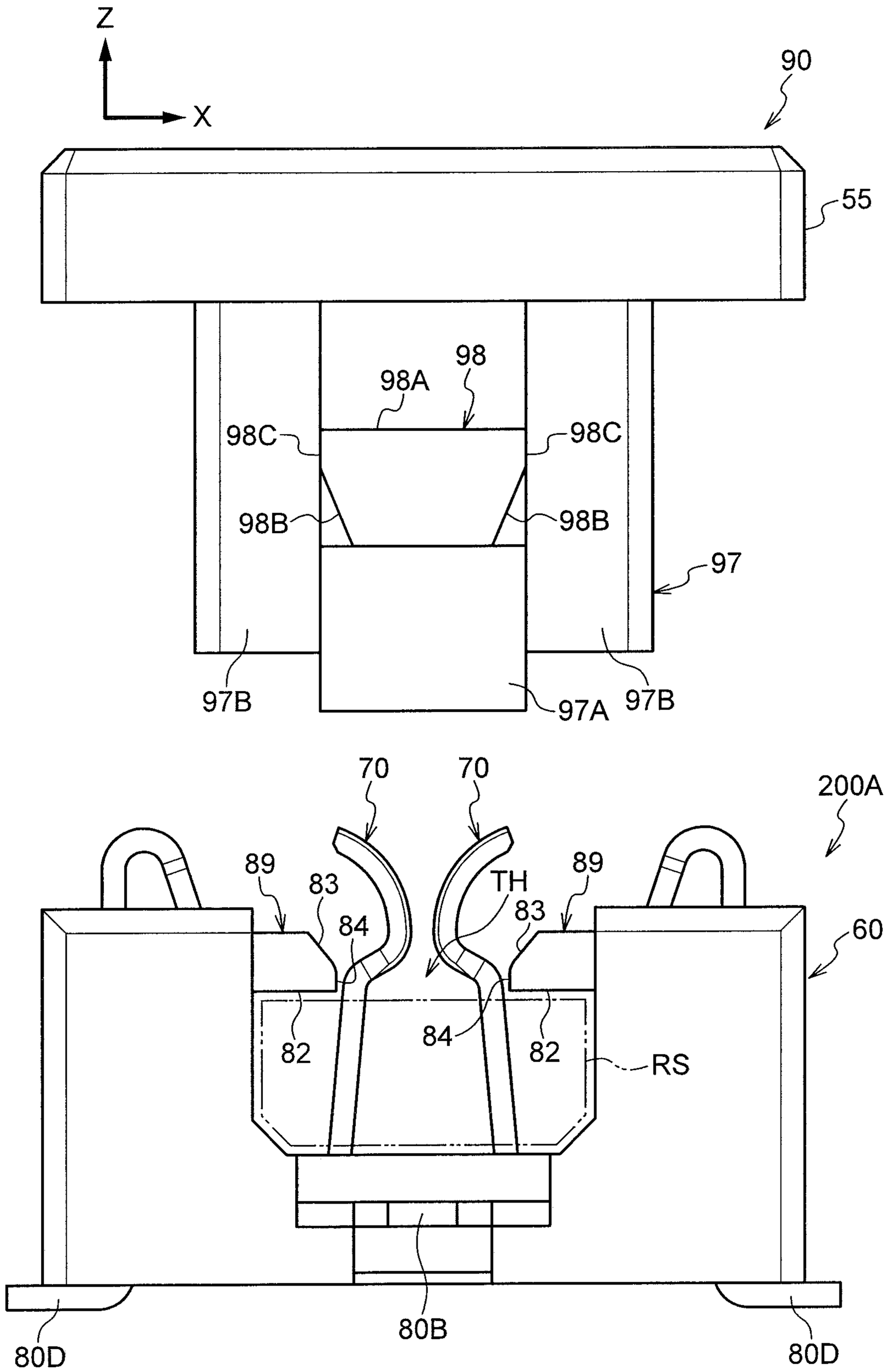
51
Y
X
Z

FIG.24A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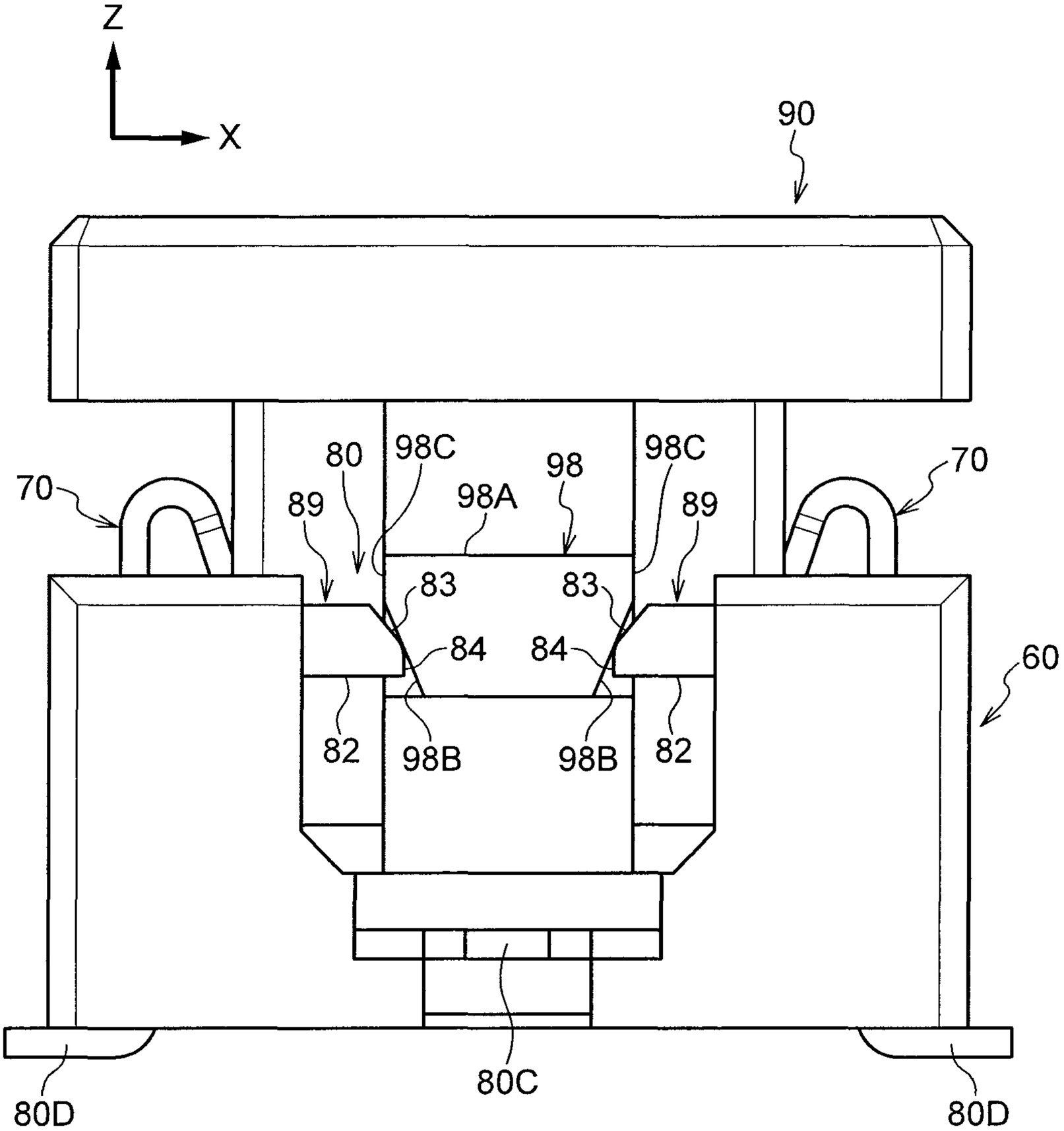
80D

FIG.24B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80D

FIG.24C

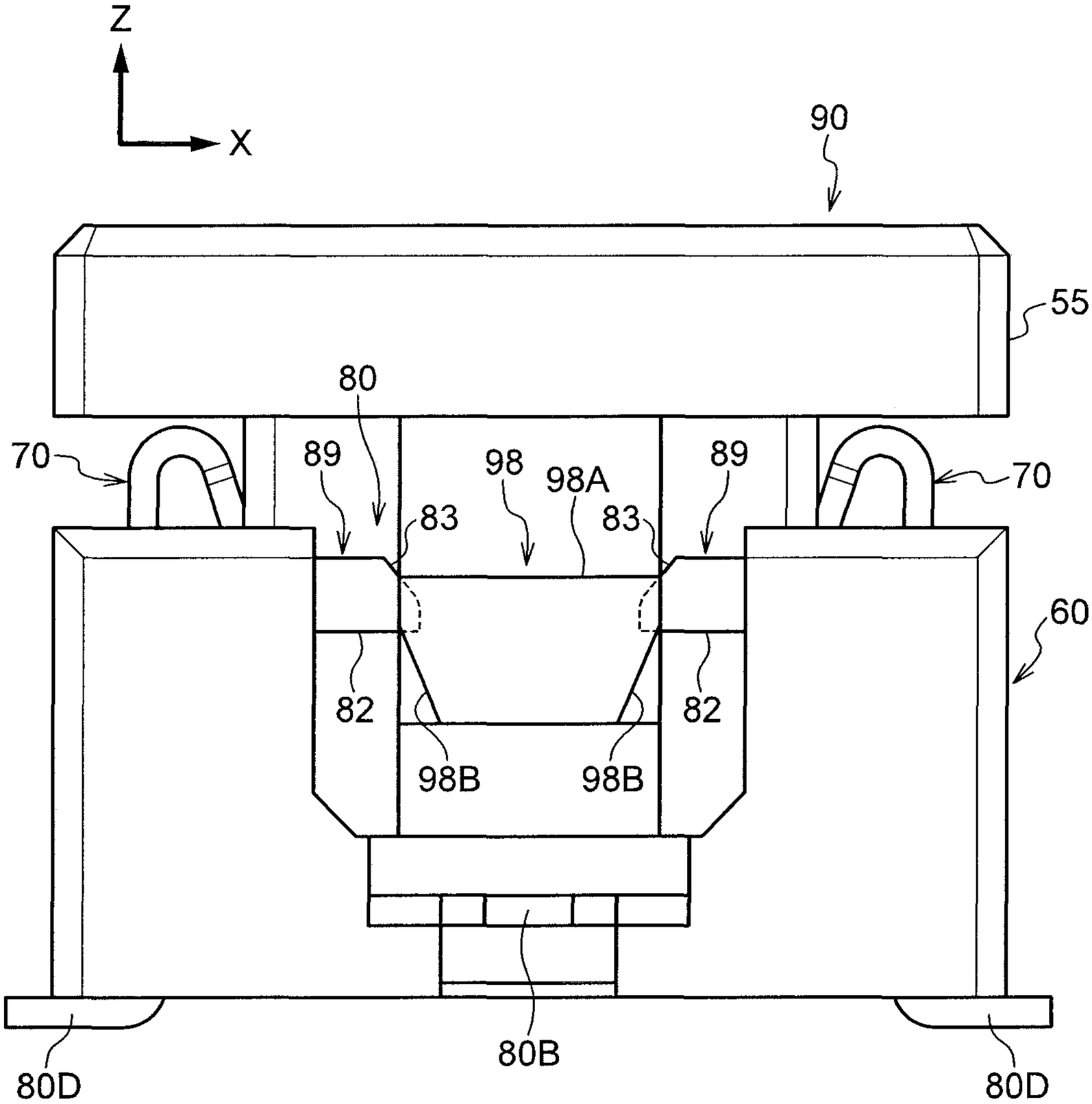
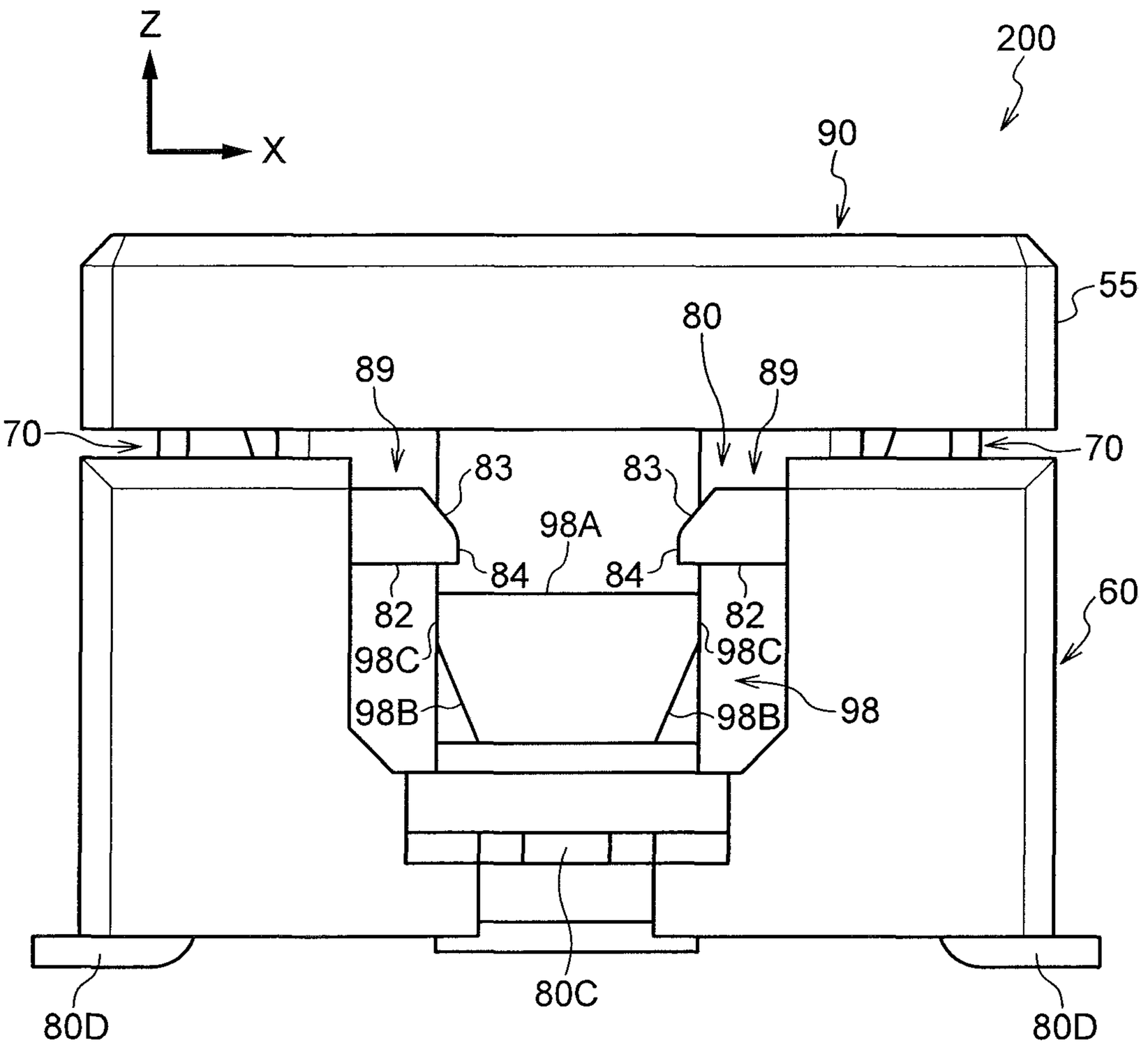


FIG.25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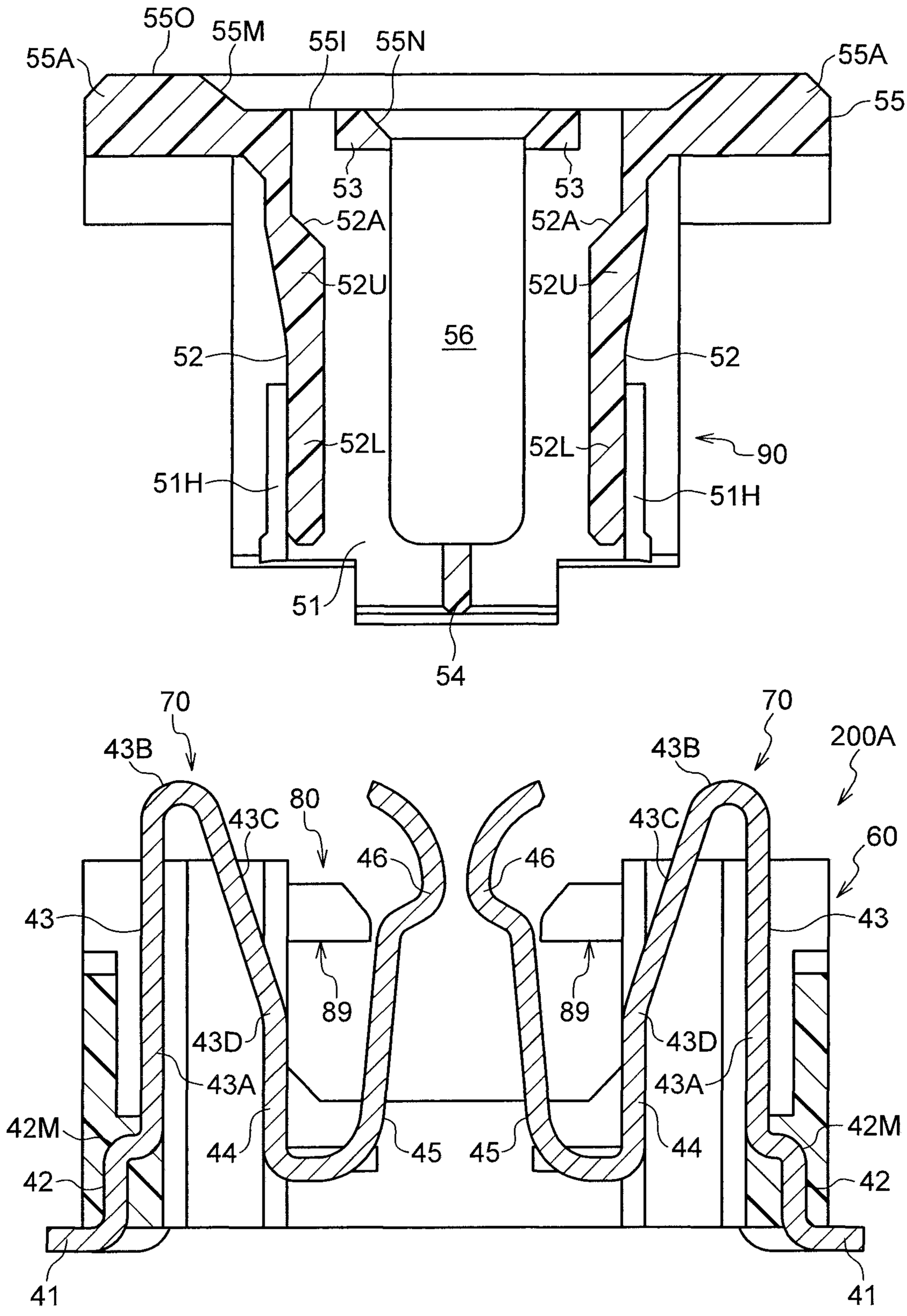
80D
80D

FIG.26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51H
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43D
43A
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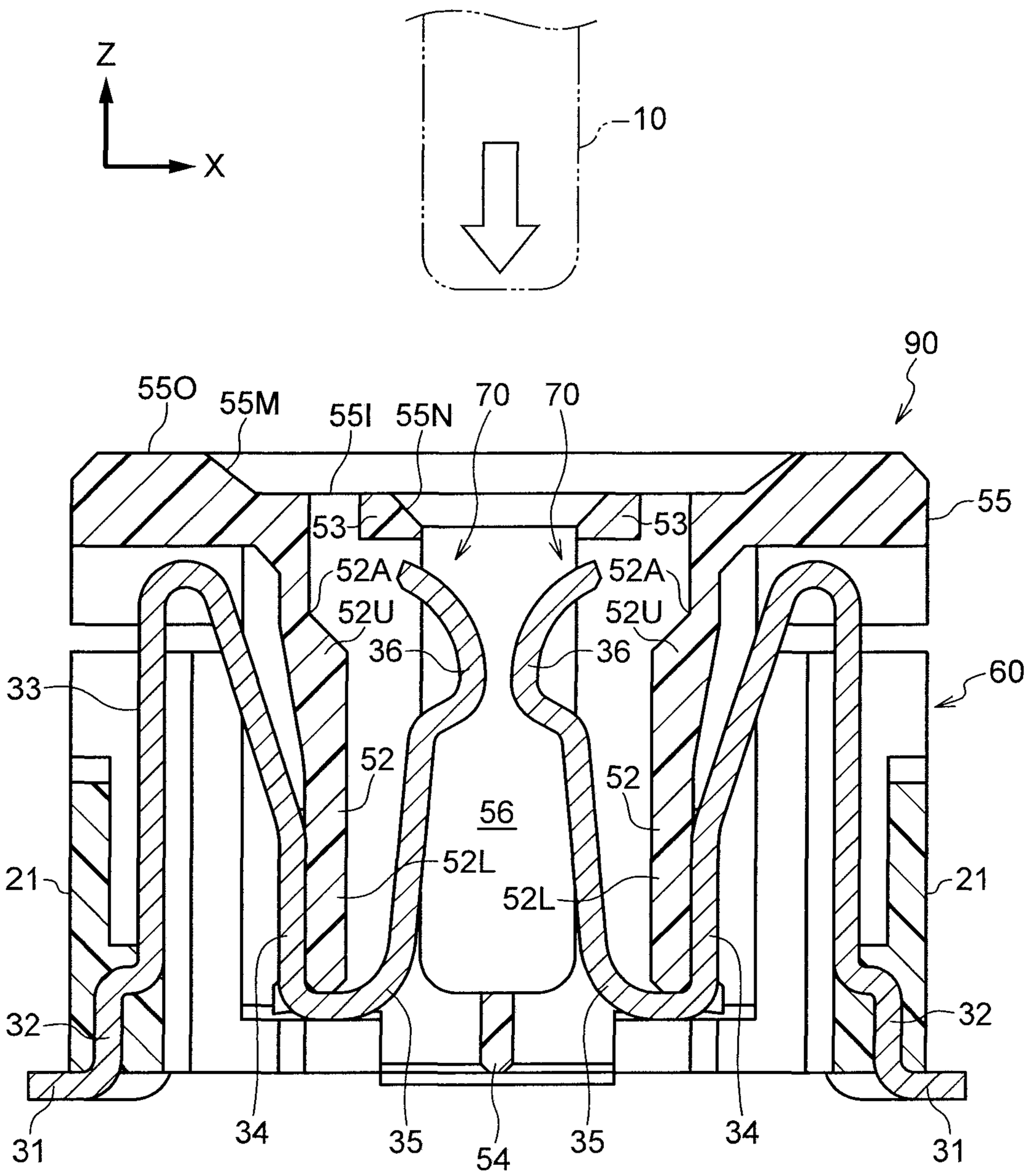
FIG.27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60
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52
56
52L
52L
21
21
32
32
31
34
35
54
35
34
31

FIG.28

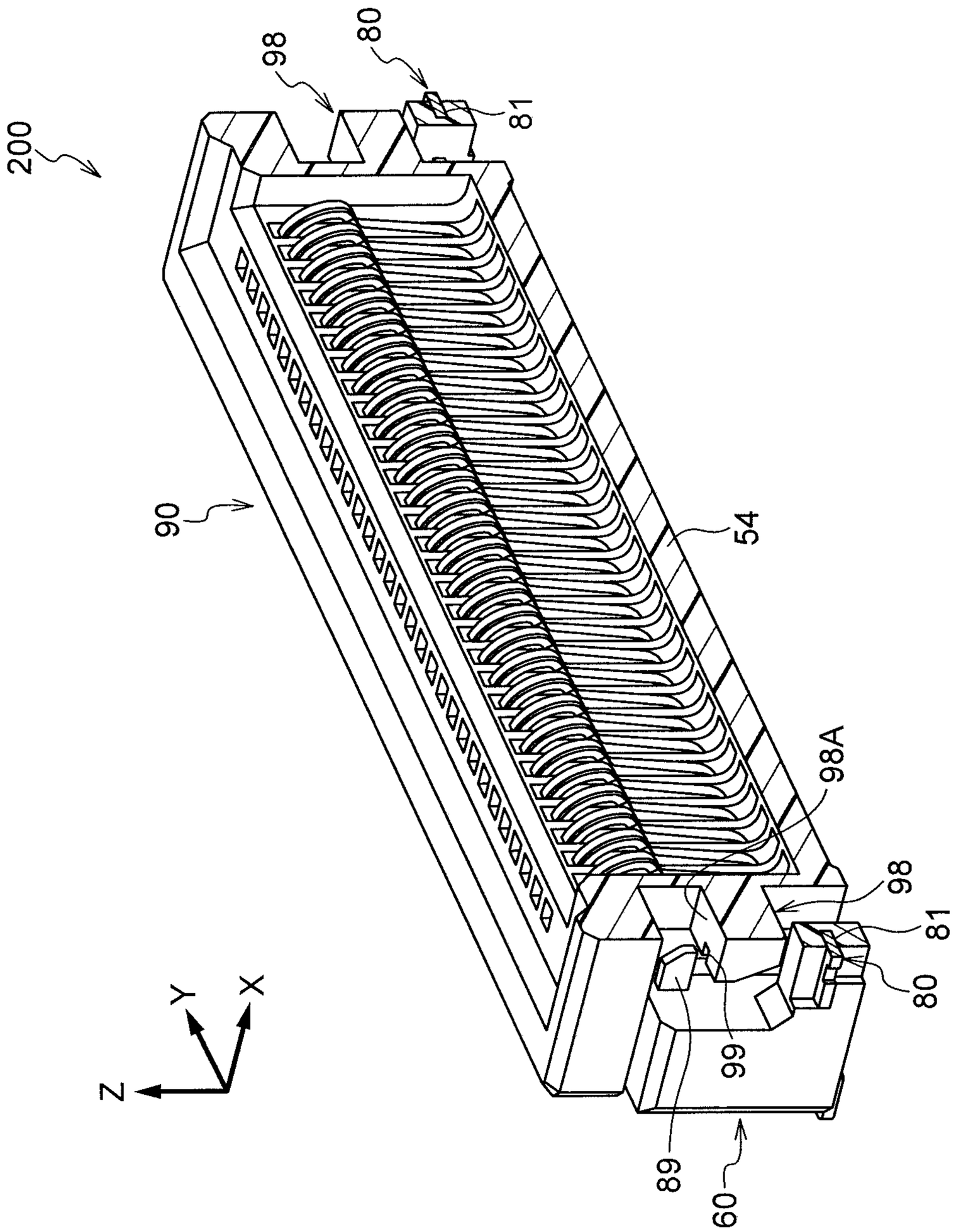
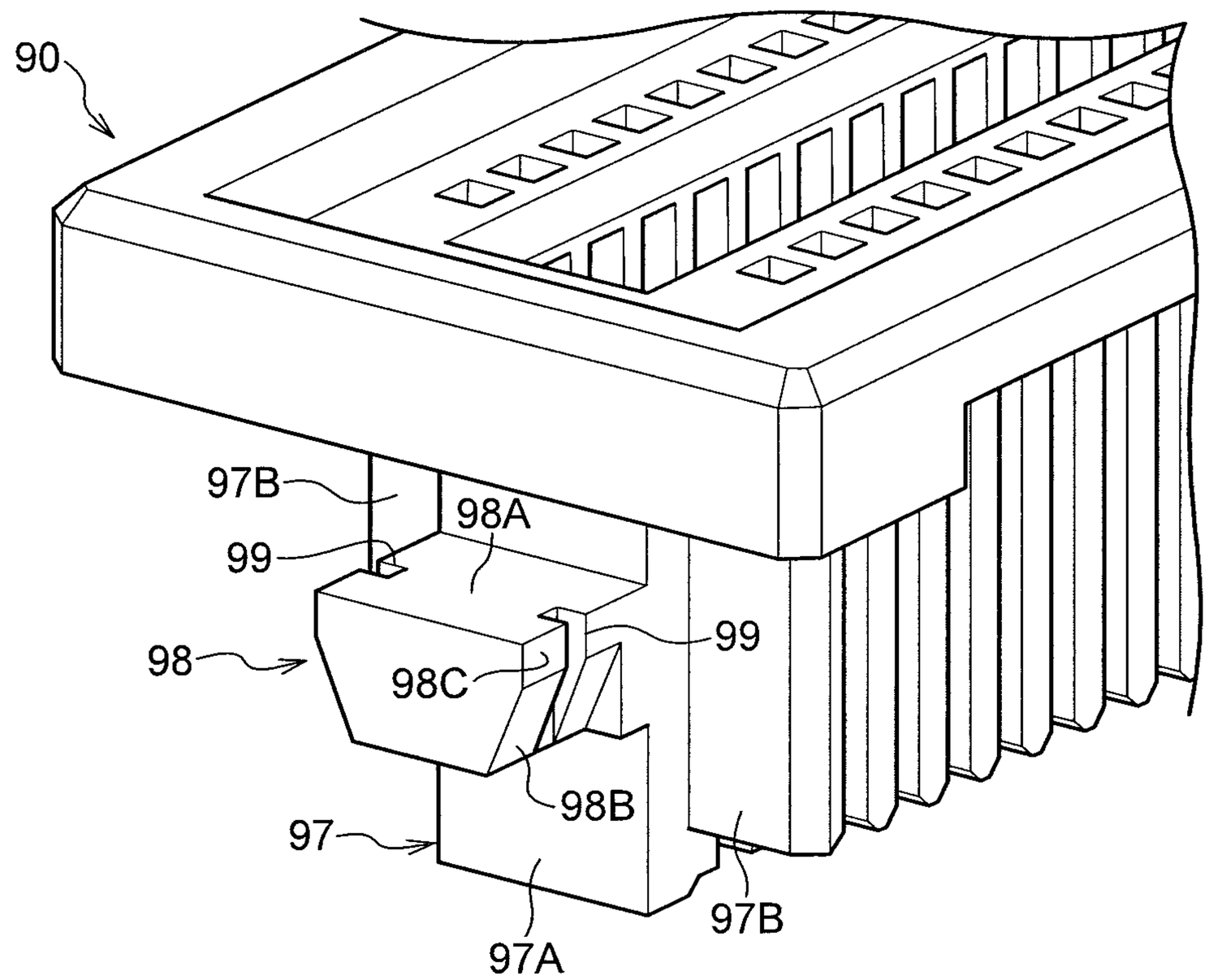


FIG.29



MOVABLE CONNECTOR

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims priority to Japanese Patent Application Nos. 2018-199154, filed on Oct. 23, 2018, and 2018-199155, filed on Oct. 23, 2018, the contents of which are hereby incorporated by reference.

TECHNICAL FIELD

The present disclosure relates to a movable connector.

BACKGROUND ART

Movable connectors such as the movable connector 20 of Patent Document 1 are known.

This movable connector 20 includes a stationary housing 21, a movable housing 22, elastically deformable terminals 23 that each have one end and another end press-fitted into and respectively retained at these two housings, and fixing fittings 24 that are press-fitted into and retained at the stationary housing 21. These elements include a protrusion 22d provided to each of the two ends of the movable housing 22, and a recess 21e corresponding to the protrusion 22d provided to each of the two ends of the stationary housing 21. The fixing fittings 24 are disposed on the stationary housing 21 so as to cover the recesses 21e.

Patent Document 1: Japanese Patent Application Laid-Open (JP-A) No. 2014-67706

SUMMARY OF INVENTION

Technical Problem

In the movable connector described above, in cases in which retention of terminals with respect to the housings (in the stationary housing 21 and the movable housing 22) is achieved by performing press-fitting, there is sometimes residual stress remaining in the vicinity of portions of the housing where the terminals have been press-fitted. Residual stress leads to the housings being readily deformed when placed in a high temperature environment (and in particular when applying reflow solder).

Alternatively, retaining the terminals in the housings using insert molding has been contemplated. Retaining terminals by insert molding enables residual stress to be suppressed more than when press-fitting.

However, the mold becomes complex when insert molding is performed, and the design of the mold is sometimes difficult depending on the shapes of the housings. In particular, for a movable connector including a stationary housing and a movable housing, this often leads to a complex shape being imparted to the movable housing.

An object of the present disclosure is to suppress residual stress in a stationary housing and to secure degrees of freedom for design of a movable housing for a movable connector including a stationary housing and a movable housing.

Solution to Problem

A movable connector according to a first aspect is a movable connector including a stationary housing to be fixed to a substrate, a movable housing configured capable of moving relative to the stationary housing, and a terminal.

The terminal includes a stationary-side retained portion retained at the stationary housing, a movable-side retained portion retained at the movable housing, and an elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion. In the movable connector, retention of the stationary-side retained portion with respect to the stationary housing is achieved by performing insert molding, and retention of the movable-side retained portion with respect to the movable housing is achieved by performing press-fitting.

In this aspect the movable connector includes the stationary housing to be fixed to the substrate, the movable housing configured capable of moving relative to the stationary housing, and the terminal. The terminal includes the stationary-side retained portion retained at the stationary housing, the movable-side retained portion retained at the movable housing, and the elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion.

Moreover, in this aspect, retention of the stationary-side retained portion with respect to the stationary housing is achieved by performing insert molding, and retention of the movable-side retained portion with respect to the movable housing is achieved by performing press-fitting.

Namely, residual stress in the stationary housing is suppressed due to retention of the terminal with respect to the stationary housing being performed by insert molding, and also, degrees of freedom in the shape of the portion on the movable housing side of the terminal and in the shape of the movable housing are secured due to retention of the terminal with respect to the movable housing being performed by press-fitting.

Thus, this aspect enables residual stress in the stationary housing to be suppressed and also degrees of freedom in the design of the movable housing to be secured in the movable connector including the stationary housing and the movable housing.

A movable connector according to a second aspect is the first aspect further including a restriction fitting integrated with the stationary housing. The restriction fitting includes a counterpart engagement portion capable of restraining an engagement portion that is part of the movable housing in a restraint space that is a predetermined region by abutting the engagement portion from a connector upward direction. The counterpart engagement portion forms a through-pass section to permit the engagement portion to pass into the restraint space from outside.

In this aspect the movable connector includes the restriction fitting integrated with the stationary housing. The restriction fitting includes the counterpart engagement portion, and the counterpart engagement portion is capable of restraining the engagement portion that is part of the movable housing in a restraint space that is a predetermined region by abutting the engagement portion from the connector upward direction. Thus in a completed state of the connector, the engagement portion is restrained in the restraint space by the counterpart engagement portion abutting the engagement portion from the connector upward direction, and further movement of the engagement portion in the connector upward direction is impeded.

Moreover, the counterpart engagement portion forms the through-pass section to permit the engagement portion to pass into the restraint space from outside. This enables assembly of the movable housing by passing the engage-

ment portion of the movable housing through the through-pass section and the engagement portion entering into the restraint space from outside.

Thus as described above, the connector according to this aspect can be manufactured by assembling the movable housing to the work-in-progress after the restriction fitting has been integrated with the stationary housing in advance.

Note that integrating the stationary housing and the restriction fitting together is not limited to performing insert molding. For example, the stationary housing and the restriction fitting may be integrated together by the restriction fitting being press-fitted into the stationary housing.

Moreover, the "through-pass section to permit the engagement portion to pass into the restraint space from outside" may be a configuration in which passing is permitted by the restriction fitting deforming so as to widen the through-pass section, may be a configuration in which passing is permitted by the counterpart engagement portion contacting the engagement portion to deform the engagement portion, or may be another embodiment.

A movable connector according to a third aspect is the first or the second aspect, wherein the movable connector further includes a fixing fitting including a retained portion retained at the stationary housing and a substrate fixing portion to be fixed to the substrate, and retention of the retained portion with respect to the stationary housing is achieved by performing insert molding.

In this aspect the movable connector further includes the fixing fitting including the retained portion retained at the stationary housing and the substrate fixing portion to be fixed to the substrate. The retention of retained portions with respect to the stationary housing is performed by insert molding. Thus when molding the stationary housing, not only can the terminal be retained at the stationary housing, but the fixing fitting can also be retained at the stationary housing at the same time.

Note that an example is explained in an exemplary embodiment described later in which the "fixing fitting" simultaneously also functions as the "restriction fitting" (second aspect). However, a fixing fitting separate to the restriction fitting may be provided.

Method of Manufacturing Movable Connector A method of manufacturing a movable connector of a fourth aspect is applied to a movable connector including a stationary housing to be fixed to a substrate, a movable housing configured capable of moving relative to the stationary housing, and a terminal including a stationary-side retained portion retained at the stationary housing, a movable-side retained portion retained at the movable housing, and an elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion. The movable connector manufacturing method includes a stationary-side process of retaining the fixed-side retained portion of the terminal in the stationary housing by integrally molding the stationary housing together with the terminal using insert molding, and a movable-side process performed after the stationary-side process in which the movable-side retained portion is retained at the movable housing by press-fitting the movable-side retained portion of the terminal retained at the stationary housing into the movable housing.

This aspect enables residual stress in a stationary housing to be suppressed and degrees of freedom for design of a movable housing to be secured for a movable connector including the stationary housing and the movable housing.

Advantageous Effects

As explained above, the present disclosure exhibits the excellent advantageous effect of enabling residual stress in the stationary housing to be suppressed and also enabling degrees of freedom in the design of the movable housing to be secured in the movable connector including the stationary housing and the movable housing.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view illustrating terminals of a first exemplary embodiment.

FIG. **2** is a perspective view illustrating a restriction fitting (on a connector right side) of the first exemplary embodiment.

FIG. **3** is a perspective view illustrating a restriction fitting (on a connector left side) of the first exemplary embodiment.

FIG. **4** is a perspective view illustrating a state in which terminals and restriction fittings have been arranged prior to performing insert molding in the first exemplary embodiment.

FIG. **5** is a perspective view illustrating a work-in-progress of the first exemplary embodiment.

FIG. **6** is a perspective view illustrating a state prior to an assembly process in the first exemplary embodiment.

FIG. **7** is a perspective view illustrating a movable connector of the first exemplary embodiment.

FIG. **8** is a cross-sectional perspective view corresponding to FIG. **6** and illustrating a state prior to an assembly process in the first exemplary embodiment.

FIG. **9** is a cross-sectional perspective view illustrating a movable connector of the first exemplary embodiment.

FIG. **10** is a (cross-sectional) side view illustrating a state prior to an assembly process in the first exemplary embodiment.

FIG. **11**A is a (cross-sectional) side view illustrating a point in time that a movable housing contacts counterpart engagement portions in an assembly process.

FIG. **11**B is a (cross-sectional) side view illustrating a point in time that engagement portions of the movable housing contact the counterpart engagement portions in the assembly process.

FIG. **11**C is a (cross-sectional) side view illustrating a state in which restriction fittings have deformed to widen a through-pass section in the assembly process.

FIG. **11**D is a (cross-sectional) side view illustrating a state in which the assembly process has been completed.

FIG. **12** is an enlarged view of part of FIG. **11**D illustrating a state in which the assembly process has been completed.

FIG. **13** is a cross-section (vertical cross-section sectioned along a connector width direction) illustrating a movable connector of the first exemplary embodiment.

FIG. **14** is another cross-section (vertical cross-section sectioned along the connector width direction) illustrating a movable connector of the first exemplary embodiment.

FIG. **15** is a perspective view illustrating terminals of a second exemplary embodiment.

FIG. **16** is a perspective view illustrating a restriction fitting (on a connector right side) of the second exemplary embodiment.

FIG. **17** is a perspective view illustrating a restriction fitting (on a connector left side) of the second exemplary embodiment.

FIG. **18** is a perspective view illustrating a state in which terminals and restriction fittings have been arranged prior to performing insert molding in the second exemplary embodiment.

FIG. **19** is a perspective view illustrating a work-in-progress of the second exemplary embodiment.

FIG. **20** is a perspective view illustrating a state prior to an assembly process in the second exemplary embodiment.

FIG. **21** is a perspective view illustrating a movable connector of the second exemplary embodiment.

FIG. **22** is a cross-sectional perspective view corresponding to FIG. **20** and illustrating a state prior to an assembly process in the second exemplary embodiment.

FIG. **23** is a cross-sectional perspective view illustrating a movable connector of the second exemplary embodiment.

FIG. **24**A is a side view illustrating a state prior to assembly in the second exemplary embodiment.

FIG. **24**B is a side view illustrating a point in time that engagement portions of a movable housing contact counterpart engagement portions in an assembly process.

FIG. **24**C is a side view illustrating a state in which counterpart engagement portions are digging into engagement portions in the assembly process.

FIG. **25** is a side view illustrating a state in which the assembly process has been completed.

FIG. **26** is a (cross-sectional) side view illustrating a state prior to an assembly process in the second exemplary embodiment.

FIG. **27** is a cross-section (vertical cross-section sectioned along a connector width direction) illustrating a movable connector of the second exemplary embodiment.

FIG. **28** is another cross-section (vertical cross-section sectioned along a connector front-rear direction) illustrating a movable connector of the second exemplary embodiment.

FIG. **29** is an enlarged perspective view of part of a movable housing (in a movable connector completed state) of the second exemplary embodiment.

DESCRIPTION OF EMBODIMENTS

First Exemplary Embodiment

Explanation follows regarding a first exemplary embodiment of the present disclosure, with reference to FIG. **1** to FIG. **14**.

In the following explanation, the arrow X, the arrow Y, and the arrow Z in the drawings respectively indicate a connector forward direction, one side (a left side) in a connector width direction, and a connector upward direction. Unless specifically stated otherwise, reference to the front and rear, up and down, and width (left and right) refer to the front and rear in a connector front-rear direction, up and down in a connector up-down direction, and width (left and right) in the connector width direction (left-right direction).

Movable Connector Manufacturing Process

Explanation follows regarding a manufacturing process of a movable connector **100** (FIG. **7**) according to the first exemplary embodiment.

First, terminals **30** (FIG. **1**) and restriction fittings **40** (FIG. **2**, FIG. **3**) are made.

Next, as illustrated in FIG. **4** to FIG. **5**, a stationary housing **20** is molded into a single body with the terminals **30** and the restriction fittings **40** by insert molding (work-in-progress manufacturing process). The result is referred to as work-in-progress **100**A.

Next, as illustrated in FIG. **6** and FIG. **7**, a movable housing **50** is assembled to the work-in-progress **100**A from above (assembly process). The movable connector **100** is completed thereby.

Detailed explanation follows regarding the assembly process, with reference to FIG. **11**A to FIG. **11**D.

During assembly of the movable housing **50** to the work-in-progress **100**A from above, first, as illustrated in FIG. **11**A, enlarged faces **57**B of side walls **57** of the movable housing **50** are contacted with counterpart engagement portions **49** of the restriction fittings **40**.

Next, as illustrated in FIG. **11**B, inclined portions **58**B of engagement portions **58** are contacted with folded portions (bent portions **44**, inclined portions **45**, and vertical portions **46** in FIG. **12**) of the counterpart engagement portions **49**. The movable housing **50** is moved further downward from this state toward the state illustrated in FIG. **11**C, and the deformation amount of the restriction fittings **40** is gradually increased.

After the counterpart engagement portions **49** surpass the engagement portions **58**, the deformed restriction fittings **40** return to their original shapes under elastic force (FIG. **11**D). Note that in cases in which complete return to their original shape is not achieved under elastic force then shape recovery may be achieved by additional pressing.

In the assembly process as illustrated in FIG. **8** to FIG. **9**, part (a movable-side retained portion **34**) of each of the terminals **30** is press-fitted into and retained at the movable housing **50**.

When in the completed state of the movable connector **100** as illustrated in FIG. **11**D and FIG. **12**, if the movable housing **50** moves in the connector upward direction, abutting portions **58**A configuring upper faces of the respective engagement portions **58** abut abutting portions **48** (a lower end **46**L of a folded portion and an upper edge **47**U of a through hole **47** in FIG. **12**) of the counterpart engagement portions **49**, thereby limiting a movement range of the movable housing **50** in the connector upward direction.

Restraint Space RS, Through-Pass Section TH When in the completed state of the movable connector **100**, each of the engagement portions **58** of the movable housing **50** is in a state entered into a region (restraint space RS in FIG. **10**) formed by the counterpart engagement portion **49** of the corresponding restriction fitting **40** and lying at the lower side of the counterpart engagement portion **49**. The engagement portions **58** are restrained in the restraint space RS, thereby limiting a movement range of the movable housing **50** in the connector upward direction.

By contrast, in a state prior to the assembly process (the state in FIG. **11**A), the engagement portions **58** of the movable housing **50** are not present at the lower side of the counterpart engagement portions **49** of the restriction fittings **40**. The engagement portions **58** are therefore in a state outside of the restraint space RS.

Accordingly, the assembly process (FIG. **11**A to FIG. **11**D) may be described as being a process of moving the engagement portions **58** into the restraint space RS from outside by passing the engagement portions **58** through between a pair of the counterpart engagement portions **49** (i.e. the through-pass section TH in FIG. **10**).

In the present exemplary embodiment, in the assembly process the engagement portions **58** are passed through the through-pass section TH by deforming the restriction fittings **40** to widen the through-pass section TH (a spacing D**1** between the pair of counterpart engagement portions **49**, this being a spacing in the connector width direction in the present exemplary embodiment) (FIG. **11**C). When in the completed state of the movable connector **100** as illustrated in FIG. **11**D, the through-pass section TH that was widened is narrowed under the elastic force of the restriction fittings **40**.

Terminals

A single movable connector **100** includes multiple terminals **30**. As illustrated in FIG. **1**, the multiple terminals **30** are disposed in pairs so as to oppose each other along the connector front-rear direction, and multiple of the terminal pairs **30**, **30** are arrayed along the connector width direction.

The terminals **30** are formed by punching out from a sheet material and then bending.

As illustrated in FIG. **1** and FIG. **13**, each of the terminals **30** includes a stationary-side retained portion **32** retained at the stationary housing **20**, the movable-side retained portion **34** retained at the movable housing **50**, and a movable portion **33** positioned between the stationary-side retained portion **32** and the movable-side retained portion **34**.

As illustrated in FIG. **9** and FIG. **13**, the stationary-side retained portion **32** is retained at the stationary housing **20** by being integrated with the stationary housing **20** by insert molding. The stationary-side retained portion **32** is configured including a bent portion **32**M. Namely, the stationary-side retained portion **32** is retained at the stationary housing **20** in a state in which the bent portion **32**M is embedded in the stationary housing **20**.

The movable-side retained portion **34** is retained at the movable housing **50** by being press-fitted into the movable housing **50**. As illustrated in FIG. **1**, the movable-side retained portion **34** is formed with projections **34**A to be retained at the movable housing **50** by being press-fitted therein. The projections **34**A are shaped so as to enable the terminals **30** to be press-fitted upward into the movable housing **50**.

The movable portion **33** is configured so as to readily undergo elastic deformation. Relative movement of the movable housing **50** with respect to the stationary housing **20** is accordingly permitted. As illustrated in FIG. **1**, the movable portion **33** includes, in the following sequence from one end **30**A to another end **30**B, a first linear portion **33**A extending upward from the stationary-side retained portion **32**, a bent portion **33**B bent so as to be upwardly convex, a second linear portion **33**C extending obliquely downward and toward the connector front-rear direction inside, and a bent portion **33**D between the second linear portion **33**C and the movable-side retained portion **34**.

Each of the terminals **30** further includes a contact portion **36** configured to contact a connection target **10** (FIG. **13**) inserted into the connector from above. The contact portion **36** is positioned further toward the other end **30**B side than the movable-side retained portion **34**. The contact portion **36** has a curved profile so as to be convex on the connector front-rear direction inside, and the convex portion of the curved profile is configured to contact the connection target **10**. The contact portion **36** includes a bent portion **36**M between the contact portion **36** and an elastic portion **35**, described later, with the bent portion **36**M projecting the contact portion **36** toward the connector front-rear direction inside (the connection target **10** side).

Each of the terminals **30** includes the elastic portion **35** configured to undergo elastic deformation when the contact portion **36** contacts the connection target **10**. The elastic portion **35** is positioned between the movable-side retained portion **34** and the contact portion **36**. A spacing between each of the pairs of terminals **30**, **30** that oppose each other in the connector front-rear direction is pushed wider by the connection target **10** being inserted therebetween, and the elastic portions **35** undergo elastic deformation. The contact portions **36** thereby make pressing contact with the connection target **10**.

Restriction Fitting

There are two of the restriction fittings **40** provided to each movable connector **100**. These two restriction fittings **40** have the same structure as each other.

Each of the restriction fittings **40** includes retained portions **41**, **42** retained at the stationary housing **20**. The restriction fittings **40** are integrated with the stationary housing **20** by insert molding, such that the restriction fittings **40** are retained at a state in which the retained portions **41**, **42** are embedded in the stationary housing **20** as illustrated in FIG. **5** and FIG. **12**.

Each of the restriction fittings **40** includes the counterpart engagement portion **49** to limit the movement range of the movable housing **50** in the upward direction with respect to the stationary housing **20** by abutting part of the movable housing **50** (the engagement portions **58**) from the upper side.

Each of the counterpart engagement portions **49** includes, in the following sequence, an upward-extending portion **43** extending upward from the retained portion **41** side, a bent portion **44** formed at a leading end side of the upward-extending portion **43**, an inclined portion **45** formed at a leading end side of the bent portion **44**, and a vertical portion **46** formed at a leading end side of the inclined portion **45**. The bent portion **44**, the inclined portion **45**, and the vertical portion **46** are formed by folding the leading end side of the upward-extending portion **43** over toward the connector width direction inside (the through-pass section TH side), and correspond to a "folded portion" of the present disclosure.

When pushing the movable housing **50** into the work-in-progress **100**A during assembly, part of the movable housing **50** (the engagement portions **58**) contacts the folded portion (i.e. the bent portion **44**, inclined portion **45**, and vertical portion **46**) of the restriction fittings **40**, such that a force pushing the pair of counterpart engagement portions **49** wider is applied to the restriction fittings **40**. When this occurs, the restriction fittings **40** adopt a state deformed from the base end side of the upward-extending portions **43**, such that the upward-extending portions **43** are tilted in a plate thickness direction (see FIG. **11**C). When the movable housing **50** is pushed further downward therefrom, the engagement portions **58** of the movable housing **50** surpass leading ends (the lower ends **46**L of the vertical portions **46**) of the folded portions of the counterpart engagement portions **49**. When this occurs, the restriction fittings **40** recover under elastic force such that the restriction fittings **40** return to their original shapes.

Note that in cases in which there is some residual plastic deformation of the restriction fittings **40** and the restriction fittings **40** do not return completely to their original shapes, then a separate force may be applied to the restriction fittings **40** to cause the restriction fittings **40** to recover to their original shapes.

The through hole **47** is formed through the upward-extending portion **43**. There is accordingly a pair of arms **43**A, **43**A formed on either side of the through hole **47** in upward-extending portion **43** and arranged in a row along the connector front-rear direction.

As illustrated in FIG. **12**, an upper edge **47**U of the through hole **47** is formed at an up-down direction position aligned with the lower end **46**L of the vertical portion **46** (lower end of the folded portion). The upper edges **47**U of the through holes **47** and the lower ends **46**L of the vertical portions **46** thus configure the abutting portions **48** that abut the engagement portions **58** of the movable housing **50**.

The restriction fittings **40** are formed by punching out from a sheet material and then bending. As illustrated in

FIG. **2** and FIG. **3**, the majority of each restriction fitting **40** is configured by a width facing portion **40**A having a plate thickness direction running in the connector width direction. An up-down facing portion **40**B having a plate thickness direction running in the up-down direction is formed at a lower side of the width facing portion **40**A on the other side of a bent portion. Front-rear facing portions **40**C having a plate thickness direction running in the connector front-rear direction are formed at both front-rear direction sides of the width facing portion **40**A on the other side of bent portions. Fixed portions **40**D to be fixed to the substrate by soldering or the like are formed at the lower sides of the front-rear facing portions **40**C on the other side of bent portions.

The whole of the bent portion between the width facing portion **40**A and the up-down facing portion **40**B ends up in an embedded state in the stationary housing **20** as part of the retained portion **41** described above. Moreover, the whole of the bent portions between the width facing portion **40**A and the front-rear facing portions **40**C end up in an embedded state in the stationary housing **20** as part of the retained portions **42** described above.

As illustrated in FIG. **2**, the through hole **47** in the upward-extending portion **43** includes upward enlarged portions **47**A, **47**A. Portions on both width direction sides of the through hole **47** are enlarged upward at the upward enlarged portions **47**A, **47**A. A portion of the upper edge **47**U of the through hole **47** between the upward enlarged portions **47**A, **47**A configures the abutting portion **48**.

The through hole **47** in the upward extending portion **43** also includes downward enlarged portions **47**B, **47**B. Portions on both width direction sides of the through hole **47** are enlarged downward at the downward enlarged portions **47**B, **47**B. The length of the pair of arms **43**A is thus extended downward to facilitate widening of the through-pass section TH by deformation of the restriction fittings **40**.

On the restriction fittings **40**, upper ends of the width facing portions **40**A, the front-rear facing portions **40**C, and the bent portions therebetween are positioned above base portions **43**N of the upward-extending portion **43**. The retained portions **42** of the restriction fittings **40** are thus enlarged upward with respect to the base portions **43**N of the upward-extending portion **43**. This secures a long up-down dimension of the upward-extending portion **43** as well as firm retention of the restriction fitting **40** with respect to the stationary housing **20**.

Stationary Housing

As illustrated in FIG. **13**, the stationary housing **20** includes terminal retention portions **21**H for retaining the stationary-side retained portions **32** of the terminals **30**. The terminal retention portions **21**H are formed in front-rear walls **21**, **21** of the stationary housing **20**. Namely, the stationary-side retained portions **32** of the terminal **30** are retained at an embedded state in the front-rear walls **21**, **21** of the movable connector **100**.

A thickness of lower portions **21**L of the front-rear walls **21**, **21** of the stationary housing **20** is increased so as to project toward the connector front-rear direction inside with respect to upper portions **21**U of the front-rear walls **21**, **21**. The stationary-side retained portions **32** of the terminals **30** are retained at the lower portions **21**L of the front-rear walls **21**, **21** of the stationary housing **20**. Part of the first linear portions **33**A of the movable portions **33** of the terminals **30** is thereby positioned at the connector front-rear direction inside of the upper portions **21**U of the front-rear walls **21**, **21** of the stationary housing **20**.

As illustrated in FIG. **12**, the stationary housing **20** includes fitting retention portions **22**H for retaining the retained portions **41**, **42** of the respective restriction fittings **40**. The fitting retention portions **22**H are formed in side walls **22**, **22** formed on the two connector width direction sides of the stationary housing **20**.

As illustrated in FIG. **5**, each of the side walls **22** of the stationary housing **20** includes a pair of high wall portions **22**S, **22**S arranged along the connector front-rear direction, and a lower wall portion **22**M connecting lower portions of the high wall portions **22**S, **22**S together. The retained portions **41** of the restriction fittings **40** are retained at the lower wall portions **22**M, and the retained portions **42** of the restriction fittings **40** are retained at the high wall portions **22**S. Spaces are formed between the front and rear high wall portions **22**S, and the counterpart engagement portions **49** of the deformed restriction fittings **40** are able to enter therein.

Movable Housing

As illustrated in FIG. **8** and FIG. **9**, the movable housing **50** includes terminal retention portions **51**H configured to retain the movable-side retained portions **34** of the respective terminals **30**. The terminals **30** are retained by the movable-side retained portions **34** of the terminals **30** being press-fitted into the corresponding terminal retention portions **51**H.

As illustrated in FIG. **8**, the movable housing **50** includes a receiving portion **56** to receive the connection target **10**. The receiving portion **56** is a groove (space) opening toward an upper side of the movable housing **50**, having a depth direction running in the connector downward direction, and extending along the connector width direction. As illustrated in FIG. **9**, the contact portions **36** of the terminals **30** retained at the movable housing **50** are disposed inside the receiving portion **56**, such that the connection target **10** contacts the contact portions **36** of the terminals **30** when the connection target **10** is inserted into the receiving portion **56**.

The movable housing **50** includes plural partitioning walls **51** disposed between the respective terminals **30**. The plural partitioning walls **51** are provided at uniform intervals along the connector width direction. Each of the terminals **30** is disposed between neighboring partitioning walls **51**, **51**.

A terminal press-fit groove **51**H is formed in part of a wall face of each of the partitioning walls **51** so as to widen the spacing between the neighboring partitioning walls **51**, **51**. The terminal press-fit grooves **51**H function as the terminal retention portions **51**H described above.

The movable housing **50** further includes coupling portions **52** to couple the plural partitioning walls **51** together along the connector width direction. The coupling portions **52** increase the strength of the movable housing **50**.

The coupling portions **52** extend along the up-down direction, and lower ends of the coupling portions **52** are positioned above lower ends of the partitioning walls **51**, while upper ends of the coupling portions **52** are connected to front-and-rear portions **55**A of an upper face **55** of the movable housing **50**, described later.

More specifically, each of the coupling portions **52** is configured by a lower portion **52**L extending along the up-down direction, and an upper portion **52**U tilted toward the connector front-rear direction outside on progression upward. As illustrated in FIG. **13**, the movable-side retained portions **34** of the terminals **30** are disposed so as to run along the lower portions **52**L of the coupling portions **52**, and the second linear portions **33**C of the movable portions **33** of the terminals **30** are disposed so as to run along the upper portions **52**U of the coupling portions **52**. The lower portions **52**L of the coupling portions **52** are disposed in relation to the movable-side retained portions **34** of the

terminals **30** so as to be substantially contacting each other, and the upper portions **52**U of the coupling portions **52** are disposed in relation to the second linear portions **33**C of the movable portions **33** of the terminals **30** so as to be spaced apart therefrom so as to thereby enable displacement of the movable portions **33**. Note that in the present disclosure, unless specifically stated otherwise, explanation regarding the placement of the terminals **30** assumes that the terminals **30** are in a free state.

Each of the terminals **30** extends from the connector front-rear direction outside of the corresponding coupling portion **52** to the connector front-rear direction inside of the coupling portions **52**, such that part of the terminal **30** (the elastic portion **35**) passes underneath the coupling portion **52**. Each of the coupling portions **52** is thus disposed between the movable portions **33** and the movable-side retained portions **34** of the terminals **30**, and the contact portions **36** of the terminals **30**.

The lower ends of the coupling portions **52** and the terminals **30** positioned below the lower ends of the coupling portions **52**A are spaced apart from each other in the up-down direction. The coupling portions **52** and the terminals **30** (the elastic portions **35** and the contact portions **36**) positioned at the connector front-rear direction inside of the coupling portions **52** are also spaced apart from each other in the connector front-rear direction. This thereby permits deformation of the elastic portions **35** of the terminals **30**.

A recess **52**A indented toward the connector front-rear direction outside is formed in the upper portion **52**U of each of the coupling portions **52**. This secures a space into which leading ends of the contact portions **36** are able to enter when the elastic portions **35** are deformed.

The movable housing **50** further includes opening edge coupling portions **53** at upward opening edges of the receiving portion **56**. The opening edge coupling portions **53** couple the plural partitioning walls **51** together in the connector width direction.

The movable housing **50** further includes a bottom coupling portion **54** at the bottom of the receiving portion **56** to couple the plural partitioning walls **51** together in the connector width direction. The bottom coupling portion **54** is configured with a structure (size and shape) to permit assembly to the movable housing **50** from below the terminals **30**.

The movable housing **50** includes the upper face **55** configuring an upper face of the movable housing **50**. The upper face **55** is formed in a rectangular shape with its length direction along the connector width direction in plan view. The upper face **55** includes the front-and-rear portions **55**A extending along the connector width direction and configuring the two connector front-rear direction sides of the upper face **55**. As illustrated in FIG. **13**, the front-and-rear portions **55**A protrude to the connector front-rear direction outsides so as to cover the movable portions **33** of the terminals **30** from above. Connector front-rear direction outside ends of the upper face **55** are thus positioned at the connector front-rear direction outsides of the movable portions **33** of the terminals **30** (the bent portions **33**B and the first linear portions **33**A thereof).

The opening edge coupling portions **53** configure part of the upper face **55**. The opening edge coupling portions **53** and the front-and-rear portions **55**A of the upper face **55** are provided so as to be separated from each other. There are accordingly, as illustrated in FIG. **8**, plural spaces present between the plural partitioning walls **51**, with the plural spaces opening onto portions of the upper face **55** between the opening edge coupling portions **53** and the front-and-rear portions **55**A.

The upper face **55** may be understood to be configured including an outer rim **55**O configuring an outer edge portion of the upper face **55**, an inner rim **55**I at the inner side of the outer rim **55**O, and a receiving opening (opening of the receiving portion **56**) inside the inner rim **55**I. The outer rim **55**O and the inner rim **55**I are each flat surfaces lying in directions normal to the connector upward direction.

The outer rim **55**O is formed higher than the inner rim **55**I. In other words, the flat surface of the outer rim **55**O is positioned further toward the connector up-down direction upper side than the flat surface of the inner rim **55**I.

An inclined portion **55**M is formed between the outer rim **55**O and the inner rim **55**I. The height of the inclined portion **55**M decreases gradually on progression from the outer rim **55**O to the inner rim **55**I. The outer rim **55**O, the inner rim **55**I, and the inclined portion **55**M are formed around substantially the entire periphery of the upper face **55**. This enables the connection target **10** to be received smoothly into the receiving portion **56**.

An inclined portion **55**N is also formed at the boundary between the inner rim **55**I and the receiving portion **56**. The inclined portion **55**N is formed to the opening edge coupling portions **53**.

As illustrated in FIG. **12**, the upper face **55** protrudes at the connector width direction outsides. Connector width direction outside ends of the upper face **55** are therefore positioned at the connector width direction outsides of the engagement portions **58**, described later. Moreover, connector width direction outside ends of the inner rim **55**I of the upper face **55** are positioned at the connector width direction outsides of the side walls **57** (general faces **57**A and enlarged faces **57**B thereof), described later.

The movable housing **50** includes the side walls **57** configuring walls on both connector width direction sides of the receiving portion **56** that is a groove (space) to receive the connection target **10**. A pair of the side walls **57** is provided on the two connector width direction sides.

As illustrated in FIG. **12**, the movable housing **50** includes the engagement portions **58** that limit a movement range of the movable housing **50** in the connector upward direction by abutting the restriction fittings **40** (at the counterpart engagement portions **49** thereof). The engagement portions **58** are formed on the connector width direction outside faces of the side walls **57** by being formed as projections projecting toward the connector width direction outsides.

Upper faces of the engagement portions **58** configure the abutting portions **58**A abutting the counterpart engagement portions **49** and accordingly limiting the movement range. The abutting portions **58**A are configured by flat surfaces having a normal direction oriented in the connector upward direction.

Each of the engagement portions **58** includes the inclined portion **58**B that gradually decreases the dimension (a projection amount in the present exemplary embodiment) of the engagement portion **58** on progression in the connector downward direction. The inclined portion **58**B is also configured by a flat surface.

Each of the engagement portions **58** further includes a vertical portion **58**C positioned between the abutting portion **58**A and the inclined portion **58**B.

As illustrated in FIG. **6**, a connector width direction outside face of each side wall **57** is configured including the general face **57**A and the enlarged face **57**B, which is positioned at the connector width direction outside of the

general face **57**A. As illustrated in FIG. **12**, a portion on the upper side of each engagement portion **58** configures the general face **57**A, and a portion at a lower side of each engagement portion **58** configures the enlarged face **57**B. Accordingly, as illustrated in FIG. **10**, a connector width direction dimension W**1** at a portion of the movable housing **50** to the lower side of the engagement portions **58** is larger than a connector width direction dimension W**2** of a portion of the movable housing **50** at an upper side of the engagement portions **58**. Moreover, the dimension W**1** is substantially the same as the spacing D**1** between the pair of counterpart engagement portions **49** at the two connector width direction sides (i.e. is 98% to 105% thereof).

This accordingly facilitates positioning of the movable housing **50** with respect to the work-in-progress **100**A in the connector width direction when assembling the movable housing **50** to the work-in-progress **100**A. A movable region of the movable housing **50** is accordingly secured in the connector width direction between the pair of counterpart engagement portions **49** of the restriction fittings **40** when the shapes thereof have recovered after assembly of the movable housing **50** (FIG. **11**D). Note that the vertical portions **46** of the counterpart engagement portions **49** of the restriction fittings **40** contact the general faces **57**A of the side walls **57** of the movable housing **50** when the movable housing **50** moves in the connector width direction.

Moreover, as illustrated in FIG. **6**, the enlarged face **57**B is formed in a rectangular shaped region when the shape of the enlarged face **57**B is viewed along the connector width direction. A width dimension (connector front-rear direction dimension) of the rectangular shaped region where the enlarged face **57**B is formed is larger than this dimension on the engagement portion **58**.

Operation and Advantageous Effects

Explanation follows regarding operation and advantageous effects of the present exemplary embodiment.

In the present exemplary embodiment, the movable connector **100** includes the stationary housing **20** to be fixed to the substrate, the movable housing **50** capable of moving relative to the stationary housing **20**, and the restriction fittings **40** that have been integrated with the stationary housing **20**. As illustrated in FIG. **10**, the restriction fittings **40** include the counterpart engagement portions **49**, and the counterpart engagement portions **49** are capable of restraining the engagement portions **58**, which are part of the movable housing **50**, in the restraint space RS, i.e. in a predetermined region, by abutting the engagement portions **58** from the connector upward direction.

Moreover, the counterpart engagement portions **49** form the through-pass section TH to permit the engagement portions **58** to pass into the restraint space RS from the outside. As illustrated in FIG. **11**A to FIG. **11**D, the movable housing **50** can be assembled by passing the engagement portions **58** of the movable housing **50** through the through-pass section TH to move the engagement portions **58** into the restraint space RS from the outside.

As described above, the movable connector **100** can be manufactured by assembling the movable housing **50** to the work-in-progress **100**A after the restriction fittings **40** have been integrated with the stationary housing **20** in advance.

Moreover, in the present exemplary embodiment, the movable connector **100** includes the stationary housing **20** to be fixed to the substrate, the movable housing **50** configured so as to be capable of moving relative to the stationary housing **20**, and the terminals **30**. Each of the terminals **30** includes the stationary-side retained portion **32** retained at the stationary housing **20**, the movable-side retained portion **34** retained at the movable housing **50**, and the elastically deformable movable portion **33** positioned between the stationary-side retained portion **32** and the movable-side retained portion **34**.

The retention of the stationary-side retained portion **32** in the stationary housing **20** is achieved by performing insert molding, and the retention of the movable-side retained portion **34** in the movable housing **50** is achieved by performing press-fitting.

Namely, residual stress in the stationary housing **20** is suppressed due to the terminals **30** being retained on the movable housing **50** by performing insert molding, and degrees of freedom in the shape of the movable housing **50** are secured due to the retention of the terminal **30** on the stationary housing **20** being achieved by performing press-fitting.

Accordingly, in the present exemplary embodiment the movable connector **100** including the stationary housing **20** and the movable housing **50** is capable of suppressing residual stress in the stationary housing **20** while also being able to secure degrees of freedom for design of the movable housing **50**.

In the present exemplary embodiment, the stationary housing **20** and the restriction fittings **40** are integrated together by insert molding. A process to press-fit the restriction fittings **40** into the stationary housing **20** is therefore not required.

In the present exemplary embodiment, the restriction fittings **40** are deformable so as to widen the through-pass section TH (the space between the pair of counterpart engagement portions **49** in FIG. **10**) (FIG. **11**C). Accordingly, the engagement portions **58** are able to enter the restraint space RS due to the restriction fittings **40** being deformed so as to widen the through-pass section TH when the movable housing **50** is being assembled to the work-in-progress **100**A.

In the present exemplary embodiment, each of the engagement portions **58** includes the inclined portion **58**B to guide the engagement portion **58** into the through-pass section TH. Accordingly, the engagement portions **58** can still be guided to an appropriate position even if the engagement portions **58** are somewhat out of position in the connector width direction when assembling the movable housing **50**. In particular, the inclined portions **58**B of the engagement portions **58** in the present exemplary embodiment can be contacted with the counterpart engagement portions **49** of the restriction fittings **40** when the movable housing **50** is being assembled, so as to act to gradually increase the deformation amount of the restriction fittings **40** by the inclined portions **58**B being pushed in along the connector downward direction. This enables damage to the restriction fittings **40** to be suppressed.

Each of the restriction fittings **40** in the present exemplary embodiment includes the upward-extending portion **43** extending in the connector upward direction from the retained portion **41** side and the folded portion (i.e. the bent portion **44**, the inclined portion **45**, and the vertical portion **46** in the present exemplary embodiment) formed by folding the leading end side of the upward-extending portion **43** back toward the through-pass section TH (toward the connector width direction inside). This accordingly means that sheet-end faces (cut end faces) of the restriction fittings **40** are suppressed from contacting the movable housing **50** when assembling the movable housing **50**.

In the present exemplary embodiment, the engagement portions **58** are configured so as not to abut the upward-extending portions **43** from the connector width direction by

forming the through holes **47** in the upward-extending portions **43**. The movement range of the movable housing **50** in the connector width direction is therefore not limited by the upward-extending portions **43**, enabling a large movable region of the movable housing **50** to be secured in the connector width direction.

Furthermore, the lower ends **46**L of the folded portions of the counterpart engagement portions **49** configure the abutting portions **48** that abut the movable housing **50** and limit the movement range of the movable housing **50** in the connector upward direction, and in addition the upper edges **47**U of the through holes **47** also configure the abutting portions **48** that abut the movable housing **50** and limit the movement range of the movable housing **50** in the connector upward direction. Load input to the restriction fittings **40** from the movable housing **50** is distributed thereby, suppressing deformation or damage to the restriction fittings **40**.

Another point is that, as illustrated in FIG. **10**, a connector width direction dimension W3 of the engagement portions **58** of the movable housing **50** in the present exemplary embodiment is larger than the spacing D2 between the pair of upward-extending portions **43**. This enables a large engagement amount (the dimension of overlap between the engagement portions **58** and the counterpart engagement portions **49** in plan view) to be realized between the engagement portions **58** and the counterpart engagement portions **49**.

In the present exemplary embodiment, the folded portions of the counterpart engagement portions **49** are each configured including the vertical portion **46** having a plate thickness direction aligned with the connector width direction and contacting the side wall **57** of the movable housing **50**. The cut end faces of the restriction fittings **40** are thus suppressed from damaging the movable housing **50**.

Second Exemplary Embodiment

Explanation follows regarding a second exemplary embodiment of the present disclosure, with reference to FIG. **15** to FIG. **29**.

Movable Connector Manufacturing Process Explanation

Explanation follows regarding a process to manufacture a movable connector **200** (FIG. **21**) according to the second exemplary embodiment.

First, terminals **70** (FIG. **15**) and restriction fittings **80** (FIG. **16**, FIG. **17**) are manufactured.

Next, as illustrated in FIG. **18** and FIG. **19**, a stationary housing **60** is molded into a single body with the terminals **70** and the restriction fittings **80** by insert molding (work-in-progress manufacturing process). The resultant is referred to as work-in-progress **200**A.

Next, as illustrated in FIG. **20** and FIG. **21**, a movable housing **90** is assembled to the work-in-progress **200**A from above (assembly process).

Specifically, as illustrated in FIG. **24**A, the movable housing **90** is disposed above the work-in-progress **200**A, and the movable housing **90** is then moved downward. When this is performed, as illustrated in FIG. **24**B, engagement portions **98** of the movable housing **90** contact counterpart engagement portions **89** of the restriction fittings **80** of the work-in-progress **200**A.

When the movable housing **90** is then further lowered, as illustrated in FIG. **24**C, leading end portions of the pair of counterpart engagement portions **89** dig into the engagement portions **98**. Namely, leading end portion of the pair of counterpart engagement portions **89** cause plastic deformation to occur in the engagement portions **98** of the movable housing **90**.

When the movable housing **90** is lowered still further, the engagement portions **98** pass between the pair of counterpart engagement portions **89** (the through-pass section TH in FIG. **24**A). When this occurs, as illustrated in FIG. **25**, the engagement portions **98** enter a region (restraint space RS in FIG. **24**A) at the lower side of the pair of counterpart engagement portions **89**. Even if an upward force is applied to the movable housing **90** in this state, the movable housing **90** is not pulled out due to the engagement portions **98** contacting the pair of counterpart engagement portions **89**. Namely, a state is achieved in which the engagement portions **98** are restrained to the restraint space RS and a movement range of the movable housing **90** in the connector upward direction is limited by the restriction fittings **80**. Note that in a completed state of the movable connector **200**, gouged grooves **99** (FIG. **29**) are formed in the engagement portions **98** corresponding to the plate thickness of the counterpart engagement portions **89** of the restriction fittings **80**. However, the movable housing **90** does not come out as long there is not perfect alignment between the positions of the gouged grooves **99** and the positions of the counterpart engagement portions **89**. Perfect alignment between the two members virtually never occurs. There is accordingly no problem to restrain the engagement portions **98** of the movable housing **90** in the restraint space RS without any issues occurring.

Terminals

As illustrated in FIG. **15**, the configuration of the terminals **70** of the second exemplary embodiment is similar to that of the terminals **30** of the first exemplary embodiment (FIG. **1**), and so they are allocated the same reference numerals and explanation thereof is omitted.

Restriction Fittings

As illustrated in FIG. **16** and FIG. **17**, the configuration of the restriction fittings **80** of the second exemplary embodiment differs greatly from that of the restriction fittings **40** (FIG. **2**, FIG. **3**) of the first exemplary embodiment.

Two of the restriction fittings **80** are provided for each of the movable connectors **200**. These two restriction fittings **80** have the same structure as each other.

Each of the restriction fittings **80** includes retained portions **81** that are retained at the stationary housing **60**. The restriction fittings **80** are integrated with the stationary housing **60** by insert molding to achieve a state in which the retained portions **81** are embedded in the stationary housing **60** as illustrated in FIG. **19** and FIG. **28**.

The restriction fittings **80** are formed by punching out from a sheet material and then bending. As illustrated in FIG. **16** and FIG. **17**, each restriction fitting **80** includes width facing portions **80**A having a plate thickness direction running in the connector width direction, an up-down facing portion **80**B having a plate thickness direction running in the up-down direction formed on the other side of a bent portion at a lower side of the width facing portion **80**A, and front-rear facing portions **80**C having a plate thickness direction running in the connector front-rear direction formed at both connector front-rear direction sides of the width facing portion **80**A on the other side of bent portions. Fixed portions **80**D to be fixed to the substrate by soldering or the like are formed at the lower sides of the front-rear facing portions **80**C on the other side of bent portions.

The whole of the bent portions between the width facing portions **80**A and the up-down facing portion **80**B and the whole of the bent portions between the width facing portions

80A and the front-rear facing portions 80C end up in an embedded state in the stationary housing 60 as part of the retained portions 81 described above.

Each of the restriction fittings 80 further includes the counterpart engagement portions 89 that abut part of the movable housing 90 (the engagement portions 98) from a connector upward direction so as to limit a movement range of the movable housing 90 in the upward direction relative to the stationary housing 60.

A pair of the counterpart engagement portions 89 are provided to each restriction fitting 80. A "through-pass section TH" through which the engagement portions 98 of the movable housing 90 pass is configured between the pair of counterpart engagement portions 89. The pair of counterpart engagement portions 89 have a plate thickness direction running in the connector width direction, and form part of the width facing portions 80A described above.

In the completed state of the movable connector 200, the portions of the counterpart engagement portions 89 that abut the engagement portions 98 of the movable housing 90 are referred to as abutting portions 82. The abutting portions 82 extend parallel to the connector front-rear direction (connector horizontal direction).

Each of the counterpart engagement portions 89 includes an inclined portion 83 inclined such that a spacing between the counterpart engagement portions 89 gradually narrows on progression in the connector downward direction. The inclined portions 83 are formed to each of the pairs of the counterpart engagement portions 89.

Each of the counterpart engagement portions 89 further includes a vertical portion 84 at the lower side of the inclined portion 83. The vertical portions 84 are formed so as to be contiguous to the lower ends of the inclined portion 83. The vertical portions 84 extend along the connector up-down direction, and the spacing between the pair of counterpart engagement portions 89 does not change along the vertical portions 84.

Stationary Housing

The configuration of the stationary housing 60 of the second exemplary embodiment has substantially the same structure and function as that of the stationary housing 20 of the first exemplary embodiment (FIG. 5, FIG. 13, etc.), and is therefore allocated the same reference numerals, and explanation thereof is omitted.

Movable Housing

Configuration of the movable housing 90 of the second exemplary embodiment having substantially the same structure and function as the configuration of the movable housing 50 of the first exemplary embodiment (FIG. 8 etc.) are allocated the same reference numerals, and explanation thereof is omitted.

As illustrated in FIG. 20, the movable housing 90 includes the engagement portions 98. The engagement portions 98 are portions projecting toward the connector width direction outsides from side walls 97 of the movable housing 90.

Each of the engagement portions 98 includes an abutting portion 98A to abut the counterpart engagement portion 89 when the movable housing 90 moves in the upward direction in the completed state of the movable connector 200. The abutting portions 98A are upper faces of the engagement portions 98, and are flat surfaces having a normal direction oriented in the upward direction.

Each of the engagement portions 98 includes inclined portions 98B inclined such that a dimension of the engagement portion 98 in the connector front-rear direction (the direction in which the pair of counterpart engagement portions 89 oppose each other) gradually increases on progression in the connector upward direction. The inclined portions 98B are formed as pairs in the connector front-rear direction.

As illustrated in FIG. 29, the side walls 97 of the movable housing 90 are configured including general portions 97A formed with the engagement portions 98 projecting therefrom, and reduced-size portions 97B, which are indented toward the connector width direction inside with respect to the general portions 97A. The reduced-size portions 97B are formed at the two connector front-rear direction sides of the general portion 97A. The reduced-size portions 97B abut the high wall portions 22S of the side walls 22 of the stationary housing 60 when the movable housing 90 has moved in the connector width direction in the completed state of the movable connector 200, thereby limiting the movement range of the movable housing 90 in the connector width direction. A large movable region of the movable housing 90 in the connector width direction is thereby achieved by forming the reduced-size portions 97B.

Operation and Advantageous Effects

Explanation follows regarding operation and advantageous effects of the present exemplary embodiment. Note that explanation is omitted regarding operation and advantageous effects originating from configuration similar to that of the first exemplary embodiment.

The movable connector 200 in the present exemplary embodiment includes the stationary housing 60 to be fixed to the substrate, the movable housing 90 that is capable of moving relative to the stationary housing 60, and the restriction fittings 80 integrated with the stationary housing 60. As illustrated in FIG. 24A, each of the restriction fittings 80 includes the counterpart engagement portions 89, and the counterpart engagement portions 89 are capable of restraining the engagement portions 98 in the restraint space RS, i.e. a predetermined region, by abutting the engagement portions 98 configuring part of the movable housing 90 from the connector upward direction.

The counterpart engagement portions 89 moreover form the through-pass section TH to permit the engagement portions 98 to pass through into the restraint space RS from the outside. Accordingly, as illustrated in FIG. 24A to FIG. 25, the movable housing 90 can be assembled by passing the engagement portions 98 of the movable housing 90 through the through-pass section TH such that the engagement portions 98 enter the restraint space RS from outside.

As described above, the movable connector 200 can be manufactured by assembling the movable housing 90 to the work-in-progress 100A after the restriction fittings 80 have been integrated with the stationary housing 60 in advance.

Moreover, in the present exemplary embodiment, as illustrated in FIG. 29, the gouged grooves 99 corresponding to the plate thickness of the counterpart engagement portions 89 of the restriction fittings 80 are formed in the engagement portions 98 of the movable housing 90. The movable connector 200 of the present exemplary embodiment can thus be manufactured by assembling the movable housing 90 to the work-in-progress 200A by plastically deforming the engagement portions 98 using the counterpart engagement portions 89.

Moreover, the engagement portions 98 in the present exemplary embodiment include the inclined portions 98B to guide the engagement portions 98 into the through-pass section TH. Accordingly, the engagement portions 98 can still be guided to an appropriate position even if the engagement portions 98 are somewhat out of position in the connector front-rear direction when the movable housing 90 is being assembled. In particular, the counterpart engage-

ment portions **89** in the present exemplary embodiment function as blades to form the gouged grooves **99** in the engagement portions **98**, so that the inclined portions **98**B of the engagement portions **98** act to gradually increase the amount of digging in of the counterpart engagement portions **89** into the engagement portions **98** (the amount of digging in in the connector front-rear direction).

Moreover, in the present exemplary embodiment, the engagement portions **98** include vertical faces **98**C at the upper sides of the inclined portions **98**B. This thereby secures the strength of the engagement portions **98**.

The counterpart engagement portions **89** in the present exemplary embodiment include the inclined portions **83** to guide the engagement portions **98** into the through-pass section TH. The engagement portions **98** can accordingly be guided to an appropriate position even if the engagement portions **98** are somewhat out of position in the connector front-rear direction when the movable housing **90** is being assembled. In particular, the counterpart engagement portions **89** in the present exemplary embodiment function as blades to form the gouged grooves **99** in the engagement portions **98**, such that the inclined portions **83** of the counterpart engagement portions **89** act to gradually increase the amount by which the counterpart engagement portions **89** dig into the engagement portions **98**.

Moreover, in the present exemplary embodiment, the counterpart engagement portions **89** include the vertical portions **84** at the lower sides of the inclined portions **83**. This thereby enables the strength of the counterpart engagement portions **89** to be secured, enabling the assembly process to be performed in a consistent manner.

Supplementary Explanation to the Above Exemplary Embodiments

Regarding the movable connector manufacturing process, modifications may be made to the processes described in the above exemplary embodiments.

For example, the stationary housing and the restriction fittings may be first integrated together by press-fitting or the like, after which the movable housing is assembled, and then the terminals are finally retained by press-fitting into the stationary housing and the movable housing.

Alternatively, for example, the stationary housing may be first molded as a single body with the terminals by insert molding, after which the terminals may be retained at the movable housing by press-fitting or the like, and the restriction fittings may be finally integrated together with the stationary housing by press-fitting or the like.

In the exemplary embodiments described above, although explanation has been given regarding a movable connector having multiple terminals **30**, **70** arrayed therein, the present disclosure is not limited thereto. For example, the movable connector may be provided with a single terminal.

In the exemplary embodiments described above, although explanation has been given regarding an example in which the movable connector is for mounting to the substrate by reflow soldering, the present disclosure is not limited thereto.

In the exemplary embodiment described above, although explanation has been given regarding the movable housing **50** having the complex shape illustrated in FIG. **6**, the present disclosure is not limited thereto.

In the exemplary embodiments described above, although explanation has been given regarding examples in which the restriction fittings **40**, **80** also function as fixing fittings to be fixed the stationary housing **20**, **60** to the substrate, the present disclosure is not limited thereto. For example, the restriction fittings do not need to function as fixing fittings (i.e. fixing fittings may be provided separately to the restriction fittings).

In the exemplary embodiments described above, although explanation has been given regarding examples in which the movable housing **50**, **90** are configured entirely by a molded resin body with the engagement portions **58**, **98** configuring part of the molded resin body, the present disclosure is not limited thereto. For example, the movable housing may be configured by a molded resin body and fittings fixed to the molded resin body, with the fittings functioning as engagement portions.

EXPLANATION OF THE REFERENCE NUMERALS

100 movable connector
100A work-in-progress
20 stationary housing
30 terminal
32 stationary-side retained portion
33 movable portion
34 movable-side retained portion
40 restriction fitting
43 upward-extending portion
44 bent portion (folded portion)
45 inclined portion (folded portion)
46 vertical portion (folded portion)
46L lower end of vertical portion (leading end of folded portion, abutting portion)
47 through hole
47U upper edge of through hole (abutting portion)
48 abutting portion
49 counterpart engagement portion
50 movable housing
57 side wall
58 engagement portion
58A abutting portion
58B inclined portion
200 movable connector
200A work-in-progress
60 stationary housing
70 terminal
80 restriction fitting
83 inclined portion
89 counterpart engagement portion
90 movable housing
97 side wall
98 engagement portion
98B inclined portion
99 gouged groove

The invention claimed is:

1. A movable connector comprising:
a stationary housing to be fixed to a substrate;
a movable housing configured to be capable of moving relative to the stationary housing; and
a terminal including:
a stationary-side retained portion retained at the stationary housing,
a movable-side retained portion retained at the movable housing, and
an elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion, wherein: retention of the stationary-side retained portion with respect to the stationary housing is achieved by performing insert molding, and retention of the movable-side

retained portion with respect to the movable housing is achieved by performing press-fitting.

2. The movable connector of claim **1**, further comprising a restriction fitting integrated with the stationary housing, wherein:

the restriction fitting includes a counterpart engagement portion capable of restraining an engagement portion that is part of the movable housing in a restraint space that is a predetermined region by abutting the engagement portion from a connector upward direction; and

the counterpart engagement portion forms a through-pass section to permit the engagement portion to pass into the restraint space from outside.

3. The movable connector of claim **1**, wherein:

the movable connector further comprises a fixing fitting including a retained portion retained at the stationary housing and a substrate fixing portion to be fixed to the substrate; and

retention of the retained portion with respect to the stationary housing is achieved by performing insert molding.

4. The movable connector of claim **2**, wherein:

the restriction fitting includes a retained portion retained at the stationary housing and a substrate fixing portion to be fixed to the substrate; and

retention of the retained portion with respect to the stationary housing is achieved by performing insert molding.

5. A method of manufacturing a movable connector comprising a stationary housing to be fixed to a substrate, a movable housing configured to be capable of moving relative to the stationary housing, and a terminal including a stationary-side retained portion retained at the stationary housing, a movable-side retained portion retained at the movable housing, and an elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion, the movable connector manufacturing method comprising:

a stationary-side process of retaining the stationary-side retained portion of the terminal at the stationary housing by integrally molding the stationary housing together with the terminal using insert molding; and

a movable-side process performed after the stationary-side process in which the movable-side retained portion is retained at the movable housing by press-fitting the movable-side retained portion of the terminal retained at the stationary housing into the movable housing.

6. A movable connector comprising:

a stationary housing to be fixed to a substrate;

a movable housing configured to be capable of moving relative to the stationary housing;

a terminal including:

a stationary-side retained portion retained at the stationary housing,

a movable-side retained portion retained at the movable housing, and

an elastically deformable movable portion positioned between the stationary-side retained portion and the movable-side retained portion, wherein: retention of the stationary-side retained portion with respect to the stationary housing is achieved by performing insert molding, and retention of the movable-side retained portion with respect to the movable housing is achieved by performing press-fitting; and

a restriction fitting insert molded with the stationary housing, wherein:

the restriction fitting includes a counterpart engagement portion capable of restraining an engagement portion that is part of the movable housing in a restraint space that is a predetermined region by abutting the engagement portion from a connector upward direction; and

the counterpart engagement portion forms a through-pass section to permit the engagement portion to pass into the restraint space from outside of the restraint space.

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